REPORT RESUMES

ED 011 847 SE 000 916

SCIENCE EDUCATION RESEARCH STUDIES -- 1952.
BY- JOHNSON, PHILIP G.
OFFICE OF EDUCATION, WASHINGTON, D.C.

REPORT NUMBER OE-CIRC-334-IV PUB DATE JUN 53
EDRS PRICE MF-$0.18 HC-$2.36 56P.

DESCRIPTORS- *COLLEGE SCIENCE, *EDUCATIONAL RESEARCH, *ELEMENTARY SCHOOL SCIENCE, *SECONDARY SCHOOL SCIENCE, *SCIENCE EDUCATION, RESEARCH, SCIENCE INSTRUCTION, RESEARCH REVIEWS (PUBLICATIONS), DISTRICT OF COLUMBIA

SUMMARIES OF 78 STUDIES IN SCIENCE EDUCATION COMPLETED DURING 1952 ARE TREATED IN THIS LISTING. THE STUDIES LISTED REPRESENT THE RESPONSE TO A NATIONWIDE QUESTIONNAIRE REQUESTING COPIES OF RESEARCH REPORTS. FOR EACH ENTRY IN THE LISTING THERE ARE INCLUDED--(1) THE AUTHOR'S NAME, (2) THE TITLE OF THE STUDY, (3) WHETHER OR NOT IT IS A THESIS OR DEGREE ITEM, (4) THE YEAR THE STUDY WAS COMPLETED, (5) THE INSTITUTION WHERE THE STUDY WAS CONDUCTED, (6) THE NUMBER OF PAGES IN THE COMPLETE REPORT, (7) THE SOURCE FROM WHICH THE COMPLETE STUDY MAY BE OBTAINED, (8) A STATEMENT OF THE PROBLEM, (9) THE SOURCES OF DATA, (10) THE KIND OF STATISTICAL TREATMENT USED, AND (11) THE MAJOR FINDINGS. ENTRIES ARE LISTED ALPHABETICALLY BY THE AUTHOR'S LAST NAME. (RS)

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY.

SELECTED
SCIENCE
SERVICES

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Office of Education Washington 25, D.C.

Circular No. 334-IV June 1953

ED011847

SCIENCE EDUCATION RESEARCH STUDIES -- 1952

Prepared by
PHILIP G. JOHNSON
Specialist for Science (Secondary Schools)

This summary of research studies in science education is the third* annual listing which has grown out of a cooperative project involving the National Association for Research in Science Teaching and the Office of Education. Seventy-eight studies are reported in this summary for 1952.

Report forms for pertinent research studies were mailed to research leaders throughout the Nation in November 1952. As reports were received the summaries were prepared from the data given. No attempts were made to evaluate the quality of the research studies. The statements in the summaries of research studies were, except in a few instances, as reported by the author. The reports were sent to the Office of Education for the purpose of bringing research studies to the attention of those who seek such information.

Persons who know of related studies which were completed during 1952 but which are not included in this listing are urged to bring them to the attention of the Office of Education. These studies will then be included when this listing is revised.

The information given concerning each study includes, wherever possible, the following items in the order given: author (surname first), title of study, "non-thesis" or degree if a thesis, year study was completed, institution where study was carried out, pages in the complete report, and source from which copy of the complete study may be obtained. This is followed by a statement of the problem or problems, methods used, sources of data, statistical treatment used, and major findings. Certain additional information is available from the Office of Education but full information can be obtained best from the source given in the summary.

Since this cooperative project is in its developmental stages, suggestions concerning ways to make the summaries of increased help will be appreciated.

The members of the Research Committee of the National Association for Research in Science Teaching who assisted in the development of the 1952 summaries were: Dr. Charlotte L. Grant, Oak Park High School; Dr. Guybert P. Cahoon, Ohio State University; and Dr. Francis D. Curtis (Chairman), University of Michigan.

SE 000916

*Copies of previous listings may be obtained from the Department of Health, Education, and Welfare, Office of Education, Washington 25, D. C.

ALFKE, DOROTHY ELSA. Professional Opportunities for Women in Conservation and the Natural Sciences. Ph.D., 1952, Cornell University. 351 p. Albert R. Mann Library, Cornell University, Ithaca, New York.

Problem or Problems.--(1) To survey the types of positions women are holding in the fields of conservation and the natural sciences; (2) to obtain information from women in these positions on the nature of the work and the training and experiences they consider essential; (3) to learn from employers what positions women could hold if qualified candidates were available and to obtain information on requirements for such positions; (4) to obtain information on personal characteristics which contribute to success in the positions investigated; (5) to obtain information on trends which might be valuable as guidance information for young women considering work in conservation and natural sciences; and (6) to investigate training programs available to prepare women for the positions considered in this study.

Steps or Methods.--Exploratory letters and personal conferences with prospective employers and personnel of training institutions and a preliminary questionnaire for women employed in the field. A 15,000 mile trip covering 32 States was completed for the purpose of obtaining personal interviews with as many representative persons as possible among prospective employers, personnel of training institutions, and women employed in conservation and natural sciences. Those who could not be contacted personally were reached by questionnaire.

Sources of Data.--Interviews, reference books, periodicals, and questionnaires.

Statistical Treatment.--None.

Major Findings.--The opportunities for women in conservation and natural sciences fall into four major groups: instructional, research, interpretive, and recreational. It is possible for a woman to acquire basic training for one of these groups so that she will qualify for all or several of the positions within the group. Instructional work, for example, includes educational work in museums, zoological gardens, botanical gardens, school systems, institutions of higher learning, and public and private conservation agencies. Preparation for positions in each of these agencies is such that a well-trained woman may be eligible for employment with several. There is great need for college training designed to meet the requirements of the positions treated in this study. For many types of positions there is a need for some method of bringing together job opportunity and qualified candidate.

****

BAY, JAMES WILLIAM. Earth Sciences in the Elementary School Program. M.Ed., 1952, Wayne University. 171 p. Graduate School, Wayne University, Detroit, Michigan.

Problem or Problems.--(1) Determination of subject matter in the earth sciences believed desirable for the elementary school program. (2) Application of part of this subject matter to a unit for teaching to illustrate methods for effective teaching of such material. Unit: "Rocks and Soil." (3) Evaluation of the unit after teaching it to three fifth grade classes.

Steps or Methods.--(1) Courses of study, children's books, science readers, laymen's publications, science education, geology texts, museum exhibits, and previous writings in science education were investigated. (2) Material was summarized in table form and frequency of occurrence was determined. (3) Standards were established and material was screened to determine that believed desirable for use in elementary science program. (4) Part of this material was used to form a unit for teaching. New laboratory and classroom methods were devised. (5) The unit was taught to three fifth grade classes at Cadillac School, Detroit. (6) The teaching was evaluated.

Sources of Data.--Experimental groups, reference books, periodicals, textbooks, courses of study, museum exhibits, expert judgments, and questionnaires.

Statistical Treatment.--Comparison of frequencies.

Major Findings.--(1) List of subject matter for use in elementary grades (1-6) was compiled. Material for this is listed under four categories: (a) earth's surface, (b) fossils and earth history, (c) minerals, and (d) rocks and soil. (2) Sample unit for teaching part of material regarding "rocks and soil" is described. (3) Laboratory kits for use by individuals are described and illustrated.

****

BLACKWOOD, PAUL EVERETT. An Analysis of the Statements of Objectives, Questions, and Activities Proposed by Teachers for the Study of Two Problem Areas. Ed.D., 1952, Columbia University. 155 p. Library, Teachers College, Columbia University, New York, New York.

Problem or Problems.--To develop a working definition of the "problem approach" and to answer certain questions which arise in relation to its use in teaching. When teachers' statements of objectives, questions and activities relating to effective teaching about soil conservation and community health problems are analyzed: (1) Does the use of questions for specific planning within a problem area reveal the same educational opportunities as does the formulation of objectives relevant to that area, or does specific planning in terms of objectives reveal significantly different aspects of a problem area from the aspects emphasized by a question analysis? (2) To what extent is there close articulation between objectives and activities and between questions and activities? (3) Can criteria which will help describe the distinctive characteristics of objectives, questions and activities appropriate to the problem approach be defined? and (4) Can the criteria be reliably applied to distinguish groups of objectives, questions and activities which are and those which are not appropriate to the problem approach?

Steps or Methods.--Information to be used in answering the questions listed above was obtained by questionnaire from approximately 300 experienced teachers. These teachers wrote statements of questions, objectives, and activities which they believed were important in connection with studying a soil erosion problem and a community health and water supply problem. (a) These statements of questions and objectives were classified by judges into categories and sub-categories. The occurrence of questions and objectives in the various categories was compared. (b) Three sets of criteria were developed by which the appropriateness of objectives, of questions, and of activities to the problem approach, as defined in the study, could be judged. These were used (1) to determine whether groups of objectives, questions, and activities written by teachers are appropriate to the problem approach and (2) to study the consistency of individual teachers in this respect in writing objectives, questions, and activities. Judges applied these criteria to the responses of 30 selected teachers.

Sources of Data.--Expert judgments and questionnaires.

Statistical Treatment.--Coefficient of correlation and Chi square.

Major Findings.--(1) A collection of questions and another of objectives obtained from the same group of teachers and related to the same problem situations emphasized different aspects of the problems. This throws some doubt on the validity of the assumption that an analysis of a problem area primarily in terms of questions will serve the same function as an analysis in terms of objectives. (2) In each problem studied, a high percentage of both questions and objectives clustered in a few categories. In none of the problems, however, were identical categories of questions and objectives among the four highest categories. (3) In the problems studied, the range of objectives is greater than the range of questions. There were more sub-categories of objectives not matched by questions than of questions not matched by objectives. (4) Individual teachers did not tend to write questions which corresponded with or matched their own statements of objectives. With respect to the application of the criteria for judging the appropriateness of objectives, questions, and activities to the problem approach, two general findings may be reported: (1) It was possible for judges to apply the criteria with a high level of agreement to groups of objectives, questions, and activities for determining the orientation of these statements to the problem approach. By use of the criteria judges were able to differentiate between those groups of statements which were oriented to the problem approach and those which were not. (2) In the sample of responses studied, if an individual's questions were highly oriented to the problem approach, his statements of objectives and activities likewise tended to be highly oriented and vice versa.

****

BLICK, DAVID JAMES. A Comparison of Three Schedule Patterns in the Teaching of General Chemistry. Ph.D., 1952, Columbia University. 60 p. Library, Teachers College, Columbia University, New York, New York.

Problem or Problems.--A determination of the relative effectiveness of three different schedule patterns in the teaching of general chemistry of the University of Connecticut.

Steps or Methods.--Three groups of students were taught under three different schedule patterns. Achievement was measured by the A. C. S. Cooperative Chemistry Test for College Students. Schedule Pattern A: Two one-hour lecture periods per week and two two-hour laboratory periods per week. Schedule Pattern B: Three one-hour lecture periods per week and one three-hour laboratory period per week. Schedule Pattern C: Two one-hour lecture periods per week, one one-hour recitation period per week, and one three-hour laboratory period per week.

Sources of Data.--Experimental groups.

Statistical Treatment.--Mean, median, standard deviation, coefficient of correlation, Fisher's "t," analysis of variance and covariance, and Neyman-Johnson Technique.

Major Findings.--The schedule pattern involving two one-hour lecture periods, one one-hour recitation period, and one three-hour laboratory period per week is a more efficient time pattern than either the two one-hour lecture periods and two two-hour laboratory periods per week or the three one-hour lecture periods and one three-hour laboratory period per week when achievement is measured by the A. C. S. Cooperative General Chemistry Test for College Students. While student achievement under this pattern is not significantly superior to that under the three one-hour lecture periods and one three-hour laboratory period, this pattern permits more efficient use of staff and instructional facilities. It is much more efficient by the criterion of this test than the two one-hour lecture periods and two two-hour laboratory periods per week.

****

BOLEN, VIRGIL A. Science Teaching Facilities and Practices in Oregon Public Elementary Schools. D. Ed., 1952, University of Oregon. Library, University of Oregon, Eugene.

Problem or Problems.--(1) To determine and evaluate the prevalence of materials and equipment suggested as minimum essentials for elementary science teaching by the Oregon State Course of Study. (2) To ascertain and evaluate the extent to which the teachers in Oregon Public Elementary Schools were trained for elementary science teaching; and to secure the opinions of the teachers relative to the strength and weakness of their professional education for science teaching. (3) To determine and evaluate the procedures used by the teachers in their science teaching in Oregon Public Elementary Schools. (4) To ascertain and evaluate what the teachers believed to be their major problems in elementary science teaching. (5) To provide information that may be used by teachers, school administrators, and teacher training institutions for an improvement of their science programs.

Steps or Methods.--A Composite Information Blank was used to gather the data. A total of 3,480 blanks was mailed to a random sample of the teachers and 1,394 usable copies were returned, representing approximately 40 percent of the blanks mailed. The data were classified under the following classifications: (1) General Information; (2) Science Teaching Facilities; (3) Extent of Your Science Education; (4) Procedures You Use in Your Science Teaching; and (5) Problems of Elementary Teachers in Teaching Science.

Sources of Data.--Questionnaires.

Statistical Treatment.--None reported.

Major Findings.--(1) A large majority of the schools studied did not have adequate equipment, facilities, materials, or reference books for elementary science teaching as suggested by the Oregon State Course of Study. (2) Approximately 73 percent of all the respondents indicated they believed their professional education for science teaching was not adequate. (3) Nearly 40 percent of the respondents who had met all of the requirements for a Bachelor's degree, or better, questioned the adequacy of their professional education for science teaching. (4) Teachers included in this study expressed the opinion that biology, physical science, and methods in teaching science were the most helpful courses in their professional education for science teaching. (5) Suggestions made by respondents for the improvement of the education for prospective elementary teachers in the science area included: (a) make college science courses for elementary teachers less theoretical and more practical; (b) assist the teachers to appreciate the use of simple materials in science teaching; and (c) make college science courses less formal and use more workshop techniques. (6) Approximately 70 percent of the teachers reporting indicated they used teaching procedures involving Direct Pupil Experiences; 60 percent used teaching procedures based on Pupil Observation; while 40 percent of the respondents said they used teaching methods concerned with Verbal Symbols. (7) Approximately 60 percent of the respondents indicated their science program was organized in terms of textbook and workbook assignments while 40 percent of the teachers used experience units in planning their science teaching program. (8) A majority of the respondents indicated their major problems in elementary science teaching were intimately related to: (a) lack of equipment and facilities; (b) lack of funds for the purchase of materials; (c) lack of available materials on the child's level; and (d) lack of adequate training in their professional education for science teaching.

****

BOWYER, JOHN E. Some Aspects of Teaching About Atomic Energy in a Beginning Biology Course. M.A., 1952, Ball State Teachers College. Library, Ball State Teachers College, Muncie, Indiana.

Problem or Problems.--The problem of this research paper is to develop a teaching unit in atomic energy for use in a beginning biology course.

Steps or Methods.--A survey was made of all available books, magazines, and bulletins on atomic energy. The book companies were asked why they did not include a unit on atomic energy in the biology textbooks in use today. A survey was made of all the biology textbooks which were adopted by the State of Indiana to see what biology textbooks, if any, brought out the uses of atomic energy.

Sources of Data.--Reference books, periodicals, and expert judgments.

Statistical Treatment.--None.

Major Findings.--Listings of available materials together with sources from which the materials may be obtained. A unit on atomic energy for use in teaching elementary biology by anyone who is concerned with introducing a unit on atomic energy into the science curriculum.

****

BOYER, DONALD ALLEN. A Comparative Study of Sixth-Grade Pupils' Science Achievement in Schools Having Contrasting Science Curriculums. Ph.D., 1952, Northwestern University. 220 p. Deering Library, Northwestern University, Evanston, Illinois.

Problem or Problems.--(1) The identification of outstanding types or patterns of "adequate" and "inadequate" programs of elementary school science teaching. (2) The measurement and comparison of science achievement of a sufficient sampling of children taught under inadequate patterns with the achievement of a sampling of children taught under contrasting but adequate science programs. (3) The comparison of the achievement of gifted and slow-learning children, in terms of the adequate versus the inadequate patterns of science teaching. (4) The analysis of specific features observed in the contrasting types of curriculums, in order to seek outstanding relationships between those curriculums and the science achievement results observed in the tests.

Steps or Methods.--Not given.

Sources of Data.--Experimental groups, control groups, sampling survey of school systems, and questionnaires.

Statistical Treatment.--Mean, standard deviation, Fisher's "t," and analysis of variance and covariance.

Major Findings.--(1) Children attending schools with adequate science programs, when compared with control groups, showed superior achievement in science. The results were statistically significant at a high (1 percent) level except on one standard test part. (2) Slow learning children and to a lesser degree, average I.Q. children suffered the greatest handicap in those schools with inadequate science programs, as compared with the achievement of like-ability groups in the schools with high-quality science teaching.

****

BRAINERD, ARTHUR BURTON. A Determination of the Extent to Which Individual Elements of the Scientific Method are to be Found in High School Physics Laboratory Workbooks and Manuals. M. Ed., 1952, Boston University. 97 p. Library, School of Education, Boston University, Boston, Massachusetts.

Problem or Problems.--This investigation is an attempt to determine to what extent individual elements of the scientific method are to be found in physics laboratory workbooks and manuals intended for the use of students taking the usual introductory high school course in physics.

Steps or Methods.--The experiments in twelve high school physics laboratory workbooks and manuals were stated by investigator in question form and checked by a specialist in teaching of science to insure technically accurate and comprehensible wording at high school level. Each experiment was written on a card and checkmark placed opposite each workbook or manual under each individual step of the scientific method included in that particular experiment as outlined in that particular workbook or manual.

Sources of Data.--High school physics laboratory manuals.

Statistical Treatment.--None.

Major Findings.--Most of the individual steps of the scientific method applicable in high school physics experiments are included in the manuals, but not necessarily all steps in any one experiment. Most serious omission is step calling for experiment to be repeated. Also, steps of scientific method are not mentioned specifically nor called to attention of student. Where the manuals fail is in neglecting to include a discussion of scientific method and to point out clearly each step of the method as it occurs in the experiments outlined.

****

BRANDWEIN, PAUL F. The Selection and Training of Future Scientists. III. Hypotheses on the Nature of "Science Talent." Non-thesis, 1952, Forest Hills High School. 2 p. Author, Forest Hills High School, Forest Hills, New York.

Problem or Problems.--To clarify problems which would be useful in determining the direction of investigations on the nature of the high-level ability which has been called "science talent," to investigate a trait, or better, an element in behavior which we may call "science talent," and to define it so that we may observe it.

Steps or Methods.--The author states his hypotheses based on observations, interviews, classroom teaching, and laboratory guidance of 400 students with high-level ability in science and mathematics. Some 60 of these students have proceeded through high school into college and into work in engineering, medicine, dentistry, and various fields of research.

Sources of Data.--Experimental groups, control groups, interviews, expert judgments, and follow-up studies through college.

Statistical Treatment.--None.

Major Findings.--Three major hypotheses were presented: (1) that "There is a trait called 'science talent'; it is as clearly definable as musical or artistic talent. This trait is not necessarily a component of high general intelligence." (2) that "There is no single trait called 'science talent'; high-level ability in science (science talent) is a function of high general intelligence." (3) that "There is a trait 'science talent'; it is either a component of high general intelligence or masked by it."

The author's observations have not clearly tended to rule out any of the hypotheses stated although the weight of his observations tend to favor Two.

It seems that those who tend to favor scientific research per se (by seeking, or declaring their intentions of seeking) a doctorate of philosophy in science rather than work in the applied sciences such as engineering, medicine, and dentistry tend generally to give a picture of introversion rather than extroversion. They tend generally to have selected science as a career earlier than those who go into the applied sciences, tend generally to have higher scholastic records (ranking in class), tend generally to be able to need less assistance in selecting problems for project work, tend generally to show higher ability in mathematics, tend to show a generally greater preferment for classical music, chess, and individual rather than team sports (e.g. tennis rather than basketball) than those who go into the applied sciences. They also tend to show high-level ability earlier, (they read earlier, they are "early bloomers") than those who tend to go into the applied sciences.

****

BRANDWEIN, PAUL F. Selection and Training of Future Scientists, IV. Developed Aptitudes in Science and Mathematics. Non-thesis, 1952, Forest Hills High School. Author, Forest Hills High School, Forest Hills, New York.

Problem or Problems.—(1) Upon what bases may students with science aptitude be identified? (2) What kind of a high school program will aid in the development of science aptitudes?

Steps or Methods.--Observations on 1,400 freshmen high school students and 400 special students.

Sources of Data.--Experimental groups, control groups, interviews, expert judgments, and follow-up studies through college.

Statistical Treatment.--None.

Major Findings.--(1) Under the present educational opportunities obtaining in Forest Hills High School the great majority of students who developed science aptitude, or high-level ability in science, and whose science interests were sustained to the point where major training in science (i.e., of a vocational nature) is selected in college, are typically students with high I.Q., high-verbal ability, and high-mathematical ability (as measured by standard tests). (2) Observations on the group above indicate that a clear relationship cannot be established between developed aptitudes in science and a science interest expressed before the ninth grade. Whether the science or mathematics interest establishes itself as a developed aptitude in science depends on two presently identifiable characteristics: (a) the presence of high general ability and (b) the nature of the opportunities offered to develop the aptitude. (3) Possibly, attempts to organize valid and reliable tests of developed aptitude in science may enable us to select youngsters early enough to indicate whether the interest is stable enough to result in early, yet advanced training in skills and aptitude. (4) After the freshman year of general science, youngsters with high-level general ability are given the opportunity to select a program of science and mathematics which runs through every year of high school. This program differs from the biology, chemistry, and physics offered to other students in several major ways: the type of science is highly enriched (for instance, college texts are used in biology); the youngsters plan their own schedules and curriculum with the teacher and thus accept the major responsibility for getting the knowledge and laboratory skills desired; the classroom is considered not a place for giving information, but a place for discovering it, hence the teacher gives "no information" except as it pertains to safety; after the middle of the tenth year, each student may choose "advanced science," a course which is reserved for the prosecution of individual projects in the laboratory for as long as the student wishes, usually for the two years remaining in his or her career; each student has in addition the widest choice of a good number of co-curricular and extra-curricular activities, clubs, societies, etc. (5) Studies of these students now being carried on indicate that this program, with all its realized faults, has great promise for stimulating students to enter science, for maintaining their interest, for developing those aptitudes we label "scientific," and for sustaining the interest and increasing the developed aptitude through college and graduate school. (6) There is no personnel or manpower shortage in science, but an "opportunity" shortage instead.

****

BREUKELMAN, JOHN and ANDREWS, TED F. Offerings and Enrollments in the Secondary School Sciences in Kansas in 1951-52. Non-thesis, 1952, Kansas State Teachers College, Library, State Teachers College, Emporia, Kansas.

Problem or Problems.--To show (1) the offerings and enrollments in the sciences in Kansas high schools, (2) the subjects taught by Kansas high school science teachers, (3) some of the trends, and (4) some comparisons with the national situation.

Steps or Methods.--Inspection of Principal's Organizational Reports on file at the State Department of Education. Tabulation of: (1) total enrollment, (2) enrollment in each class of each science taught, and (3) non-science subjects taught by science teachers.

Sources of Data.--Reports in State Department of Education.

Statistical Treatment.--Median and comparison of frequencies.

Major Findings.--Of the 679 schools examined, 569 offered general science, 482 biology, 208 chemistry, and 232 physics. The most common sciences, other than the main four, were agriculture, physiology, physical geography, and aeronautics. In the schools examined, about 15,000 students were enrolled in general science, about the same in biology, about 4,500 in chemistry, and about 3,500 in physics. Class sizes were larger in general science and biology than in chemistry and physics. The most common non-science courses taught by science teachers were mathematics, physical education, home economics, and social studies.

****

BUNCE, GEORGE. A Study of How High School Graduates Who Have Not Entered College Evaluate Their High School Science Courses. M.A., 1952, Ball State Teachers College. Library, Ball State Teachers College, Muncie, Indiana.

Problem or Problems.--The purpose of this study was to collect the opinions of graduates of a number of northern Indiana public high schools concerning the value their science courses have been to them since graduation. The question also arises "Are American high schools doing a good job of teaching science to the large percentage of students who do not go to college?" This study has been an attempt to answer this question in part.

Steps or Methods.--A rating scale based upon recently stated goals of science education was prepared. The author of this study personally interviewed 87 high school graduates.

Sources of Data.--Interviews and questionnaires.

Statistical Treatment.--Comparison of frequencies.

Major Findings.--In general, men have received more help from their science courses than women have received, according to their expressed opinions. The greatest amount of criticism, though not great, directed toward science education was the lack of equipment, too few science courses offered, the need for better teachers in the small schools, and the need to make the science courses more practical for everyday living.

BURROWS, GEORGE HOWARD. National Wildlife Refuge Policy. M.S., 1952, Cornell University. 85 p. Nature Study Department, Cornell University, Ithaca, New York.

Problem or Problems.--To bring to light apparent weaknesses in existing philosophy and procedures relative to the administration of the refuge system and to suggest possible modifications with the hope that the work might stimulate more detailed future investigations.

Steps or Methods.--(1) Correspondence with officials of various conservation agencies and the New York State Department of Public Works. (2) Consultation of literature. (3) Personal interviews. (4) Material drawn from lectures by Conservationists and Cornell faculty members. (5) Visits to National Refuges and Parks.

Sources of Data.--Questionnaires, interviews, reference books, periodicals, and personal visits to Wildlife Refuges and National Parks.

Statistical Treatment.--None.

Major Findings.--Major emphasis in wildlife refuge policy should now be shifted to more effective and appropriate public use of the refuges. Wildlife observation, conservation education, and controlled wildlife photography seem altogether desirable and suitable. Off-limit areas should be carefully delineated; loud noises and fast driving prohibited. An effort should be made to create in the refuges a wild or natural appearance. Buildings should be rustic. Such pursuits as camping, swimming, boating, fishing, and picnicking should be curtailed or prohibited. Wildlife management should be modified to increase small non-game species where seen by visitors and to conceal management activities. Economic grants by the refuges should be made only when necessary to management practices. Land policies should be expansive particularly in the acquisition of more small water-fowl resting places near centers of population. A positive written policy should be announced prohibiting grants of rights-of-way. Areas abandoned by wildlife should receive habitat improvement and other treatment to re-establish the wildlife instead of giving up the refuge.

****

CRUM, GLEN LAVERNE. A Course of Study for Basic Radio in the Puyallup High School. M.Ed., 1952, University of Washington. 217 p. Suzzalo Library, University of Washington, Seattle.

Problem or Problems.--The purpose of this study was to develop a course in radio fundamentals that would give the students of radio in the Puyallup High School an understanding of the science dealing with the vacuum tube and its related electrical circuits. Since it was the desire of the writer to improve the learning experiences of all students who are interested in the intricacies of radio receivers, the course was constructed as a resource unit. This would give the instructor an abundance of material to use in teaching the radio course.

Steps or Methods.--The available guides and suggestions in teaching radio fundamentals were studied, an attempt was made to learn the construction of the resource unit, and a large collection of reference materials, teaching aids, methods, demonstrations, and experiments were gathered. These activities culminated in the development of the resource unit as a forward step in radio instruction.

Sources of Data.--Reference books, periodicals, textbooks, courses of study, and technical publications.

Statistical Treatment.--None.

Major Findings.--This study has only begun the task of preparing radio teaching aids. To meet the challenge presented by the new developments in electronics, the science teachers must begin to develop courses which will provide an understanding of the fundamental principles of all electronics.

****

CULVER, IVON EARLE. A Supervisory Program for Improving the Learning of Science in a Senior High School. D.Ed., 1952, University of Pennsylvania. 304 p. Author, 409 Valley View Road, Media, Pennsylvania.

Problem or Problems.--A survey of the community and high school. A study of the learning problems and special interests in science of nearly 900 pupils enrolled in the Upper Darby Senior High School in the year 1948-49.

Steps or Methods.--Responses were treated statistically to determine the significance of differences in learning problems due to differences in sex, reading ability, and intelligence. Recommendations were made and were evaluated by a local jury for suitability to local conditions and by a jury composed of specialists in universities, teachers colleges, and in public school systems for the desirability of the practices for improving the learning of science. The study included an analysis of differences in learning problems for differences in scientific backgrounds of the pupils.

Sources of Data.--Reference books, periodicals, interviews, expert judgments, questionnaires, and diagnostic tests.

Statistical Treatment.--Mean, standard deviation, coefficient of correlation, and critical ratio.

Major Findings.--(1) Pupils appear to memorize much of the information learned in science without understanding it. (2) There is a need for better integration of science education both vertically and horizontally. (3) Instruction in science should be correlated with other departments such as the mathematics department. (4) Pupils appear to need help in learning how to study science. (5) There appears to be a need to study vocabulary requirements to the end of determining the basic scientific vocabulary absolutely necessary for secondary science instruction. (6) Increased efforts should be made to adjust courses of study to individual differences in learning and to differences in scientific backgrounds of the pupils. (7) Programs of science education should be constantly evaluated by use of graduates and pupils enrolled in science classes. (8) Efforts to improve science instruction should be made by cooperative efforts of teachers at the elementary, junior high, and senior high school levels working together to develop understandings of the role of each level in the program. (9) Pupil interests should be utilized in the development of club programs and courses of study. (10) Advanced classes in science should be provided for gifted pupils planning science specialization in college.

****

DAVIS, WARREN MAYWOOD. Factors of Effectiveness in Science Teaching and Their Application to the Teaching of Science in Ohio's Public Secondary Schools. Ph.D., 1952, Ohio State University. 720 p. Library, Ohio State University, Columbus.

Problem or Problems.--(1) What factors are related to the effectiveness of a learning situation in secondary science? (2) To what extent is there evidence that these factors are observed or neglected in the teaching of science in the public secondary schools of Ohio? (3) What evidence exists that "factor effectiveness" of a teacher actually is related to "overall effectiveness"? (4) What steps may be taken to increase the effectiveness of science teaching in Ohio's secondary schools?

Steps or Methods.--(1) Through reading, study, and conference, there was developed a set of proposed factors of effectiveness. These were circulated for comment. (2) These factors were validated by submitting them to the total membership of the National Association for Research in Science Teaching and to a sampling of membership of three other associations. (3) The data bearing on these factors of effectiveness obtained from the Ohio State Department of Education and from questionnaires were circulated to every secondary teacher of science subjects in the public schools of Ohio and used in a personal survey of teachers in their teaching situations. (4) The data were analyzed, interpreted, and applied to the problem of the study.

Sources of Data.--Expert judgments, questionnaires, and State department records.

Statistical Treatment.--None.

Major Findings.--Seventy-four findings were reported. Among them were such items as: (1) More than one teacher in every seven in the county schools had no experience prior to the year of the study. About one in every three and a half had one year or less of teaching experience. Less than two in every three had more than two years' experience. Percentages in the exempted villages were somewhat lower, and in the cities only about one in fifteen had one year or less of experience, with less than one in 33 being a beginning teacher. About one-fourth of Ohio's science teachers received their most recent degree within the two years preceding the study. Over one-tenth of Ohio's science teachers were beginning teachers. About one-fifth had one year or less, and about three of ten had three years or less of experience. (2) Eighty-five county teachers were teaching science subjects in high school with no college preparation of any kind in any science. More than one of every three such teachers (551 of 1,470) presented less than 25 semester hours total preparation in all forms of post-secondary science. These county teachers were more often than the city teachers required to teach a number of sciences. In Ohio's city schools, 43 teachers of 864, or about one teacher in 20 presented no credit at all in any science subject. A little less than one teacher in every four in the city schools had 25 semester hours or less of science credit in total. (3) About one of every thirteen county teachers was teaching with no preparation at all in his major field of science teaching (110 or 1,470). More than half had thirty semester hours or less in their major area of science teaching. Thus, twenty-nine of 324 county teachers whose major area of science teaching was biology offered no post-secondary biology credit; five teachers of 81 in the county schools whose major area of science teaching was chemistry offered no post-secondary chemistry credit; twenty-five of 185 teachers in the county schools whose major area of teaching was physics offered no physics credit beyond secondary level. (4) In the city schools, 54 teachers of 864, or one in 16, had no science preparation in the field of their major area of science teaching. Somewhat less than half had 30 semester hours or less in the field of their major area of science teaching (363 of 864). In the city schools, 17 of 299 teachers whose major area of teaching was biology had no biology credit at post-secondary level, with 43 of 299 having had 15 hours or less. Thus one in 17 had no credit, and about one in seven had a limited amount of credit. In chemistry, nine of 152 city teachers whose major area of science teaching was in chemistry had no chemistry credit. Twenty-three had 15 hours or less. In physics in the city schools, five teachers of 98 whose major area of science teaching was in this field, had no physics credit. Twenty-five of 98, or about one-fourth of the teachers had 15 hours or less. (5) A total of 139 teachers in Ohio were teaching scientific subjects in the high schools with no college credit in any science. In addition, there were 140 teachers who may or may not have had any science credit as their records were so incomplete as not to permit judgment. These figures are based on a total of 2,541 teachers. (6) Some 24 schools of 509 in the counties possessed nothing that could be distinguished as a science room. (7) Teachers in Ohio's smallest group of county schools (enrollments 1-25 per grade), were required to teach a very wide variety of science and non-science subjects, with 60 percent of the teachers having five or more preparations per day. This percentage dropped as the size of the school increased, so that the average county high school teacher of science subjects had four preparations per day or less, however, over 30 percent of all county teachers had six, seven, or eight preparations per day. In the exempted villages, the median preparation load was three, but a little more than one teacher in 20 had five or more preparations. The median number of preparations in Ohio's city high schools was two, but some had as many as seven preparations. A negligible percentage had more than four, however, the average number of classes taught per day was about five in all classes of schools. It should be remembered that many of these were double-period classes (or seven-period-per-week classes). (8) Less than one in five of the county and exempted village teachers belonged to any science or science-education organizations or groups. Of those who did belong, more (36) belonged to the National Science Teachers Association than to any other group. In the cities, one teacher of every two and one-third claimed membership in some such organization. Here the most common type of organization was the district or State science group with a membership of 87 teachers. However, 52 of these teachers also claimed NSTA membership. (9) Only 23 of 558 county and exempted village teachers of science had no extra-curricular duties. For 227 of these teachers, or more than a third, coaching was all or a part of the extra duty, while with 108, administration or supervision entered the picture in addition to other extra-class duties. In the cities, 18 of 411 teachers did not have extra duties. There were 92 coaches, 220 who had clubs of one type or another, and 40 who were administrators or supervisors. About one in five county and exempted village teachers reporting believed that their extra-curricular load hurt their teaching. About two in five believed that it helped. The rest either had no opinion or believed that it didn't matter. In the cities, one in eight believed that his extra-curricular load was harmful, and again, two in five believed that it helped. (10) About 85 percent of the city teachers and 70 percent of the county teachers said that they felt thoroughly competent in their science laboratories. About 13 percent of the city and almost 29 percent of the county and exempted village teachers said that they felt only partially competent, while something less than 2 percent of the teachers in each case said that they felt totally incompetent in their science situations. (11) Somewhat over 60 percent in each case were one-textbook teachers according to their report; a little over 10 percent said that they used two texts; while a little over one in four reported using three or more textbooks. (12) Not more than half of the objectives of science teaching as reported by science teachers showed very great insight into or grasp of any recognizable broad philosophy for education of youth in a democracy. Many of the statements, given as sole responses to the question included somewhat limited objectives as, for instance, "preparation for college," of "teaching the course of study."

****

DeBOER, SIDNEY VERNON. An Investigation of the New York State Regents Examination in Biology for June 21, 1949. M.A., 1952, University of Michigan. Author, Battle Creek High School, Battle Creek, Michigan.

Problem or Problems.—The purpose of this study is to item analyze and evaluate completed and graded Regents Examinations of the University of the State of New York in biology. These examinations were the ones prepared for June 21, 1949. (1) A determination of the reliability of the examination. (2) A determination of validity of the examination with respect to the extent to which it measures the major objectives of science teaching. (3) A determination of the areas in which students do poorly and do well. (4) A determination of the inconsistencies in certain test items. (5) Miscellaneous difficulties involving improper scoring, and apparent misunderstandings on the parts of students and teachers.

Steps or Methods.—Not reported.

Sources of Data.—2,085 corrected and graded test papers.

Statistical Treatment.—Standard deviation and coefficient of correlation.

Major Findings.— Not reported.

****

DeLOACH, WILL S. A Chemistry Identification Question. Non-thesis, 1952, Mississippi State College for Women. 2 p. Author, Arkansas State Teachers College, Conway, Arkansas.

Problem or Problems.—The scores on a "scrambled clues" chemistry identification question are correlated with the scores on the rest of the test so as to get some evidence of the validity of the question.

Steps or Methods.—Not reported.

Sources of Data.—Experimental groups.

Statistical Treatment.—Coefficient of correlation.

Major Findings.—A "scrambled clues" type of question is described, and some evidence is given regarding its validity and reliability.

****

DeLOACH, WILL S. Doctorates in Chemistry from Southern Institutions, 1881-1951. Non-thesis, 1952, Mississippi State College for Women. 2 p. Author, Arkansas State Teachers College, Conway, Arkansas.

Problem or Problems.--Listing was made of the doctorates in chemistry, by institution by year, from the earliest in 1881 through 1951.

Steps or Methods.--Not reported.

Sources of Data.--Reference books, periodicals, and letters to universities.

Statistical Treatment.--None.

Major Findings.--Earliest doctorate in chemistry found from a southern institution was granted by Vanderbilt University in 1881. Through 1951 a total of 831 Ph.D.'s in chemistry had been granted by a total of sixteen southern institutions.

****

DeLOACH, WILL S. The Master's Degree Programs of a Group of High School Chemistry Teachers. Non-thesis, 1952, Mississippi State College for Women. 3 p. Author, Arkansas State Teachers College, Conway, Arkansas.

Problem or Problems.- Study was made of the courses taken for the master's degree by a group of Alabama high school chemistry teachers.

Steps or Methods.--Not reported.

Sources of Data.--Transcripts mostly in State Department of Education.

Statistical Treatment.--None.

Major Findings.--Of the total of thirty-one Alabama high school chemistry teachers holding master's degrees, nearly one-half received the degree after World War II, with about one-fifth in 1950. About 58 percent received the degree from Alabama institutions. About 61 percent took no work in chemistry in their master's program.

****

FINCH, RAYMOND CHARLES. A Study of the Methods of Conducting Physics Laboratory Work in Secondary Schools with Some Suggestions for Improvement by Means of Simple Research Projects. M.Ed., 1952, Cornell University. 92 p. Nature Study Department, Cornell University, Ithaca, New York.

Problem or Problems.--To examine the procedures involved in conducting physics laboratory work in secondary schools. The major emphasis is placed upon the use of simple research projects in high school physics courses. The terms, simple research project, refer to some type of problem to be solved in the laboratory which involves the application of several physical principles and skills.

Steps or Methods.--Search of literature, study of twelve high school physics laboratory manuals and one text, and questionnaire to 400 physics teachers in New York State, of which 200 were returned.

Sources of Data.--Questionnaires, textbooks, reference books, and periodicals.

Statistical Treatment.--None.

Major Findings.--In general, New York schools offering courses in physics allot at least one period per week for laboratory work. In many cases, 48 percent of those replying to the questionnaire, two periods per week are given over to this phase of the work.

Turner's Discovery Problems in Physics appears to be the most popular manual among New York teachers, although many prefer to use their own mimeographed notes.

There appears to be considerable difference of opinion among physics teachers in New York State as to which experiments are important. All of the 74 experiments in the list sent out as part of the questionnaire were checked as regular experiments. The measurement of volume and density appears to be most widely used. Very few schools require the students to carry out the exercise on tensile strength of solids. The following list of additional exercises was contributed by the teachers: Relation of sound and music; automatic siphon with colored water; ultra-violet and infra-red light; geiger tubes; lead plating; telegraph systems; mercurial barometer (construction of all necessary parts); making an air thermometer; making a stirring device; devising uses for the electric eye; measuring the height of a building by use of stone and stop watch; singing flames; electrical network board; determining types of metals by specific gravity measurements; use of school bus garage for practical applications of levers, hydraulic systems, chain-pulley systems. Suggestions for projects are classified in six broad areas.

****

GORDON, GARFORD GAILORD. A Study of Methods of Making Provision for Outstanding Science and Mathematics Students in High Schools. Ph.D., 1952, University of Southern California. 484 p. Doheny Memorial Library, University of Southern California, Los Angeles 7, California.

Problem or Problems.--What methods are being successfully used in high schools to make provision for meeting the special needs of outstanding science and mathematics students? Are there any schools and teachers who can be recognized as being clearly successful in making provision for meeting the needs of such students, or at least as being more successful than ordinary schools and teachers? If definite methods are being used for meeting the needs of such students, what implications does this fact have for the practices of schools and teachers generally?

Steps or Methods.--(1) Determination of existence of schools and teachers making good provision for outstanding science and mathematics students, using recommendations of educators, results of Science Talent Search, and results of local contests. (2) Questionnaire to schools and teachers plus visitation to selected California and Arizona schools. (3) Tabulation and interpretation of results.

Sources of Data.--Reference books, periodicals, interviews, expert judgments, questionnaires, and contest results.

Statistical Treatment.--Chi square and comparison of frequencies.

Major Findings.—Schools included in the study were found to make wide use of several organizational and extracurricular methods in providing for outstanding science and mathematics students. Teachers were found to use regularly more than nine classroom methods each in doing this. The extent of use of methods and the degree of success attributed to them were found to be highly correlated. Length of class period, administrative policies regarding the supervision of students, use of ability grouping and of special classes, and the exact nature of the subject involved—all were found to affect the extent of use of classroom methods. It was concluded, among other things, that (1) superior students were victims of excessive demands on their time, (2) ability grouping could be used in all types of schools, (3) such grouping should be based on several criteria, (4) science and mathematics departments could undertake their own programs of detecting and fostering superior students, (5) mathematics teachers were less aware of the possibilities of providing for outstanding students than were science teachers, and (6) methods found to be most widely used by teachers and schools included in this study could be recommended for widespread use by all schools and teachers.

****

GREGORY, RAYMOND NEWTON. The Dyeing of Orlon, Dacron, and Acrilan. Ph.D., 1952, George Peabody College for Teachers. 97 p. Library, George Peabody College for Teachers, Nashville, Tennessee.

Problem or Problems.—(1) To describe the processes involved in the manufacture of three very new synthetic fibers used for this study—Orlon, Dacron, and Acrilan—and to review the various theories that have been advanced to explain the dyeing of each. (2) To determine which of various classes of dyestuffs will color these fibers. (3) To determine the comparative effectiveness of these different classes of dyestuffs in their ability to dye these three synthetic fibers as compared to wool.

Steps or Methods.—Material on the various processes and theories of dyeing was obtained from all available sources, chiefly industrial laboratory reports. The best methods of applying the dyestuffs were selected from the literature reviewed. The three fibers were dyed under identical conditions and in the same dye bath at temperatures indicated for each class of dye used.

Sources of Data.—Letters from industrial and research laboratories.

Statistical Treatment.—None.

Major Findings.—A major purpose of this study was to work out the materials and methods for interesting and instructive classroom demonstrations of the dyeing properties of these three newest synthetic fibers—Orlon, Dacron, and Acrilan. This purpose was accomplished in that any teacher of chemistry, or of home economics, who would go to the trouble of obtaining the samples of the textiles and the dyes could assign the dyeing to students as a class activity and have samples mounted in a permanent notebook. In this thesis, all samples are mounted.

****

HESS, FRED CARL. Development of a Course in the Utilization of Chemistry by Marine Engineers. Ed.D., 1952, Columbia University. 82 p. Teachers College Library, Columbia University, New York 27, New York.

Problem or Problems.--The project undertaken was the development of a course at the New York State Maritime College in which students of marine engineering were to study problems in their field which could be dealt with more effectively through the utilization of a knowledge of chemistry.

Steps or Methods.--(1) A study of the institution, its purpose, history, and curricula to establish the role of the course in the institution. (2) A study of the students, their background and goals, to establish the direction of the course. (3) A study of marine engineering, its characteristics and responsibilities, to establish the professional objectives of the course. (4) A study of educational theory, to establish principles useful to the course. (5) A description of the course in operation, to illustrate the application of principles and methods employed to attain objectives. (6) A brief evaluation of the learning activities in terms of the principles derived in the studies.

Sources of Data.--Reference books and periodicals.

Statistical Treatment.--None.

Major Findings.--A course consistent with the findings of the various phases of the study was established at the institution.

****

HILFERTY, FRANK JOSEPH. Biology in New England State Teacher Training Institutions. Ph.D., 1952, Cornell University. 572 p. Mann Library, Cornell University, Ithaca, New York.

Problem or Problems.--The problem is one of providing detailed, useful information pertinent to the teaching of general introductory biological science in the New England State teacher training institutions.

Steps or Methods.--(1) Review of literature. (2) Correspondence with administrators and faculty members in New England State Teacher Training Institutions. (3) Visitations - each institution was visited at least once and 91 percent at least twice. (4) Questionnaires were filled out by the author during conferences with the personnel of each institution.

Sources of Data.--Interviews, questionnaires, reference books, and periodicals.

Statistical Treatment.--None.

Major Findings.--The general biology course in the State teacher training institutions of New England is not in a very satisfactory state.

****

JOHNSON, PHILIP G. School and Science Enrollments in a Random Sample of Identical Schools for the Fall of 1947 and the Fall of 1952. Non-thesis, 1952, U. S. Office of Education. 3 p. Author, U. S. Office of Education, Washington 25, D. C.

Problem or Problems.--(1) How have public high school enrollments changed between 1947 and 1952? (2) How have public high school science enrollments changed between

1947 and 1952? (3) How does the enrollment in 1952 compare with previous periods? (4) How have the numbers of part-time and full-time teachers changed between 1947 and 1952?

Steps or Methods.--Data from a questionnaire used in 1947 were compared with data collected from the same schools by a questionnaire used in 1952. Comparisons with results from other studies were made.

Sources of Data.--Questionnaires, reference books, and periodicals.

Statistical Treatment.--Comparison of frequencies.

Major Findings.--(1) Public high school enrollments in the reporting schools have changed as follows: 7th grade, +50.6%; 8th grade, +37.6%; 9th grade, +21.6%; 10th grade, +8.9%; 11th grade, +8.4%; 12th grade, +9.4%. For grades 7-12 this amounts to +20.0%; for grades 9-12 it equals +12.4%. (2) Public high school science enrollments in the reporting schools have changed as follows: 7th general science, +46.7%; 8th general science, +29.7%; 9th general science, +15.2%; biology, +13.5%; chemistry, -4.2%; physics, -15.6%. For grades 7-12 this amounts to +16.8%; for grades 9-12 it equals +8.1%. (3) When the fall 1952 science enrollments are compared with earlier periods, it may be noted that general science, biology, and chemistry enrollments have maintained their percentage of the school enrolled pupils. High school physics has reached a new low in percentage of high school pupils enrolled. Enrollment in science courses other than general science, biology, chemistry, and physics increased from 2.3% in 1948-49 to 3.8% in the fall of 1952. (4) The number of men teaching science full time in public high schools increased by 23.5% while the part-time men teachers increased by 16.7%. Full-time women science teachers decreased by 16.7% and part-time women science teachers decreased by14.8%.

****

JOSEPHSON, RUTH ANNIS. A Study of the Value of Field Trips for the Teaching of Natural History in the First Grade Curriculum of the Fox Point-Bayside School, Fox Point, Wisconsin. M.S., 1952, Cornell University. 104 p. Nature Study Department, Cornell University, Ithaca, New York.

Problem or Problems.--To correlate the teaching of natural history with other basic activities in the first grade curriculum and to develop a technique of conducting natural history field trips with small children which is informal, safe, effective, and spontaneous.

Steps or Methods.--The author planned and used nine field trips with her first grade pupils. The experiences gained were used as bases for activities in reading, language, music, art, and social studies. Records were kept of the children's reactions and comments, and each trip was evaluated.

Sources of Data.--Experimental groups.

Statistical Treatment.--None.

Major Findings.--The outcomes of this series of trips are as many as there were children in the group. Some results were evident. Barbara, who became hysterical with fear when she saw the snake in October, asked to be allowed to feed it in April and May. Billy grew from an immature and lonely child to an alert little boy with a passion for nature. In addition to the individual changes there was obvious growth in problem solving power, in observing, and in reporting. Eleven techniques for use of field trips were suggested.

****

KALLENBERG, ROBERT CHRISTOPHER. A Study of the Red Salmon, Oncorhynchus nerka (Walbaum), of Bristol Bay with Particular Reference to Teaching Its Conservation. M.S., 1952, Cornell University. 112 p. Nature Study Department, Cornell University, Ithaca, New York.

Problem or Problems.—To furnish the teachers in Bristol Bay with information and suggestions that may be used in teaching conservation of the salmon including a history of the canneries and development of the fishing industry, the biology and ecology of the salmon, and scientific investigations, in Bristol Bay and other areas that bear on the involved conservation problems. Suggestions are given as to how this material may be integrated with the present curriculum in developing an understanding of the conservation problems connected with maintaining a run of salmon large enough to support commercial fisheries.

Steps or Methods.--Consultation of literature followed by organization and summary of pertinent materials.

Sources of Data.--Reference books, periodicals, experience in fisheries work, and courses of study.

Statistical Treatment.--None.

Major Findings.--(1) A discussion of the development of the Bristol Bay Fishery, including the establishment of the canneries, methods of fishing, fishing regulations, and the establishment and growth of the Bristol Bay communities. (2) Biology and ecology of the salmon runs including discussions of the ability of the run to maintain itself, the development of an index to the success of the return run, the application of this index to Bristol Bay, and conservation problems relative to the Bristol Bay run of salmon. (3) A program for the use of material presented in the schools with a discussion of the development of the following concepts: photosynthesis, water cycle, erosion and deposition, density and viscosity of water, productivity of streams and lakes, lakes, relation of living things to their environment, and interdependence of living things. Also suggestions for the correlation and integration of this material with work in English, history, mathematics, and geography.

****

KERNS, LEROY R. The Understanding of Thirteen Science Concepts by Students in Grades One Through Twelve. M.A., 1952, Colorado State College of Education. 105 p. Library, Colorado State College of Education, Greeley, Colorado.

Problem or Problems.--The problem of this study originated in a twelfth grade general education class in science. The class was studying current topics in the various fields of science, their importance in their lives, in the immediate community, and in the world. Materials or articles of scientific nature were used. These were found in newspapers, periodicals, bulletins, or other sources of information. The "textbooks" were found to have ample materials and worthwhile explanations. The class progressed very nicely and with keen interest by all participants. However, one serious problem developed which impaired the progress of the class; namely, before an article could be efficiently used, much effort was necessary in order to make it meaningful because the students did not understand the scientific concepts used in the article. To find the cause of this difficulty, the purpose of this study was to determine an answer to the problem, "How do the students' understandings of a selected group of science concepts progress in grades one through twelve in the Laboratory School of Colorado State College of Education?"

Steps or Methods.--From over thirteen hundred scientific terms or concepts which were turned in as not being understood by a class in general education in science, thirteen were selected for the basis of this study. These thirteen concepts were part of the designated study of three science series textbooks and the tests used in the testing were standardized by the interpretation used in these textbooks. All grades from one through twelve were tested for understanding in these concepts, and information was gathered as to how the student encountered the concept and also his understanding of it if it was different from that as designated by the textbooks. Comparisons were then made of the data from grades one through twelve.

Sources of Data.--Tests.

Statistical Treatment.--Mean, median, comparison of frequencies, and percent comparison by grade.

Major Findings.--(1) Science concepts are not introduced before a student is capable of understanding them. (2) Many concepts could be introduced earlier. (3) The concepts are introduced simply and with much parallelism to the student's previous understanding of the concept. (4) Most of the concepts were a part of the student's vocabulary before they were introduced into his study, the understanding of which was erroneous in many respects. (5) The students encountered a use of the concepts in their social realm before they were introduced into their studies.

****

KINNARD, ROSA MAE. An Analysis of the Science Subject Matter a Competent Secondary Chemistry Teacher Needs to Know. B.S., 1952, Tennessee A. & I. State University. 27 p. Department of Science Education, Tennessee A. & I. State University, Nashville 8, Tennessee.

Problem or Problems.--The problem of the study is to analyze the science subject matter a competent secondary chemistry teacher needs to know and to evaluate the effectiveness of the Tennessee A. & I. State University curriculum in developing that subject matter competence.

Steps or Methods.--(1) Location of typical secondary chemistry textbook and/or course of study. (2) Analysis of textbook or course of study for important principles of chemistry or mathematics. (3) Examination of A. & I. curriculum for chemistry and mathematics courses commonly taken by prospective secondary chemistry teachers. (4) Determination of effectiveness of these courses in developing understanding of the principles usually included in secondary chemistry by submission of a selected list of such principles to a jury from the Department of Chemistry.

Sources of Data.--Textbooks, courses of study, and expert judgments.

Statistical Treatment.--None.

Major Findings.--(1) Sixty-two principles, theories, mathematical calculations, and important processes were isolated as important subject matter items. (2) Approximately 85 percent of the necessary chemistry subject matter is satisfactorily covered in the first year chemistry course. (3) As it was impossible to identify the remaining 15 percent of necessary items with any specific course or group of chemistry courses, it is recommended that experiences to develop these competencies be included in the general chemistry course since this is the one chemistry course common in the background of all prospective chemistry teachers enrolled at the Tennessee A. & I. State University.

****

KRUGLAK, HAYM. Achievement of Physics Students With and Without Laboratory Work. Non-thesis, 1952, University of Minnesota. Author, Department of Physics, University of Minnesota, Minneapolis 14, Minnesota.

Problem or Problems.--(1) Are there differences in the learning outcomes of general physics students who do laboratory work by the individual method and students who take the same course without laboratory? (2) Are there differences in the learning outcomes of general physics students to whom laboratory experiments are demonstrated and students who take the same course without laboratory?

Steps or Methods.--Control groups of twenty-eight taught laboratory by the individual method; experimental groups of twenty-eight taught by the demonstration method; volunteer group of twenty-one received no laboratory training. All students attended the same lectures and took the same tests. Initial status and achievement were measured by two pencil-paper and two performance examinations.

Sources of Data.--Experimental groups and control groups.

Statistical Treatment.--Mean, standard deviation, coefficient of correlation, Fisher's "t," analysis of variance and covariance, and Davis item analysis technique.

Major Findings.--(1) Students who get laboratory instruction by the individual or demonstration method are superior to students without such instruction on laboratory tests. (2) Laboratory work did not influence significantly the scores on pencil-paper theory tests. (3) The group taught by the individual method had a significantly higher mean on one performance test than either of the other two groups. The no-laboratory group had the lowest mean on all the four tests.

****

LeMASTER, ROGER A. A Content Analysis of Selected Biology Courses of Study. M.A., 1952, Ball State Teachers College. Library, Ball State Teachers College, Muncie, Indiana.

Problem or Problems.—The purpose of this original research paper is to analyze and compare the contents of twelve city and State high school biology courses of study with content recommended by experts in the field.

Steps or Methods.--The data for this original research report were gathered from two sources -- the selected biology courses of study of twelve cities and States and from a checklist sent to various experts on teaching biology. The purpose of the checklist was to find out what content experts on the teaching of biology would like to see included in a biology course of study.

Sources of Data.--Questionnaires.

Statistical Treatment.—Comparison of frequencies.

Major Findings.--If the aims of biology education are to be accomplished, more States throughout the United States should make their material available. Several of the States are revising their biology courses of study, while several others admit theirs are obsolete and out of print. Several of these States seemingly are not making any effort to rewrite and modernize their courses of study.

****

LEONELLI, RENATO EDHUND. The Selection and Grade Placement of Physical Science Principles in the Elementary School Curriculum. D.Ed., 1952, Boston University. 239 p. Library, School of Education, Boston University, 332 Bay State Road, Boston, Massachusetts.

Problem or Problems.—To determine (1) the physical science principles that should be included in the elementary school curriculum; (2) the reasons for inclusion; and (3) the grade areas wherein the principles should be introduced.

Steps or Methods.—(1) Seventeen specialists in science and eighty-four elementary science teachers participated in the study. (2) Each of the above rated a total of eighty-one physical science principles extracted from a previous dissertation by Martin Robertson, University of Michigan, 1934. (3) Each rated principles for problems as stated above. (4) Returns were compiled and treated statistically.

Sources of Data.—Reference books, periodicals, expert judgments, and questionnaires.

Statistical Treatment.--Coefficient of correlation and comparison of frequencies.

Major Findings.--(1) The correlation between what the experts believed should be included in the curriculum and what the teachers believed should be included was 0.83. (2) Seventy of the eighty-one principles were selected by more than 53 percent of the jurors. (3) Seventy of the above principles should be included for their contribution towards "an interest in and an interpretation of the community." (4) When selected for their contribution to desirable habits of work and study, no one principle received a majority selection. (5) For grade selection, no one principle was selected by a majority for a definite or single grade.

However, upon a combination of percentages, a definite area of successive grades was established for sixty-four of the eighty-one principles.

****

LOFTIN, BLAUNCH COMBS. A Collation of Selected Equipment for Use in Secondary School Science. Ed.M., 1952, University of Colorado. 82 p. Department of Education, University of Colorado, Boulder, Colorado.

Problem or Problems.--To compile a group of adaptable devices that can be easily and inexpensively constructed at home or in the science laboratory. The purpose of this report is (1) to describe the construction of equipment from inexpensive materials, (2) to make application of such apparatus for effective learning, and (3) to assist other science teachers in their research for similar aids.

Steps or Methods.--Books, periodicals, pamphlets, newspapers, manuals, and unpublished materials were surveyed for simple, inexpensive, and practical devices for use in secondary school science courses. Some of these devices were constructed in the laboratory, shop, or home and were demonstrated in the laboratory. Applications and suggestions were made as to the utility of the apparatus. Numerous forms of experimental and demonstrative apparatus were constructed from pupil experiences. Necessary articles for the construction of equipment were purchased at small cost from the hardware store, the ten-cent store, and the supply house. From the "junk-heap," garage, factory, and the industrial plant were salvaged many pieces of needed accessories. These devices, as well as those collated from the preceding sources, were included in this report. Classification was made according to the subject-field. Illustrations were provided when necessary for clarification.

Sources of Data.--Reference books, periodicals, textbooks, and laboratory construction.

Statistical Treatment.--None.

Major Findings.--(1) For best results in science teaching, simple, workable devices offered wide possibilities. (2) The construction of simple equipment was a means of developing laboratory resourcefulness, of meeting the individual needs of youth, of helping boys and girls in adjusting to life at home and in the community, of furthering the understanding and application of scientific principles, of arousing interest, of developing scientific attitudes and appreciations, and of assuring every child of an opportunity of success. (3) Teachers and pupils working together doing things led to a healthy classroom atmosphere and one in which growth could take place. (4) There was more than one way to build a piece of equipment, to illustrate scientific principles. The science class should not become stereotyped by using the same tools each day, month, or year. (5) The time and effort spent on this report had been quite worthwhile and should lead to more effective science teaching.

****

McKIBBEN, MARGARET JEAN. An Analysis of Principles and Activities of Importance for General Education in High School Courses in General Biology. Ph.D., 1952, University of Pittsburgh. Library, University of Pittsburgh, Pittsburgh 13, Pennsylvania.

Problem or Problems.--(1) To evaluate principles of biological science for general education in general biology courses in high schools. (2) To determine the relative value of activities in contributing to an understanding of principles to which they have been related for use in such courses and whether each activity would more appropriately be done as a demonstration or as an individual laboratory activity.

Steps or Methods.--(1) Evaluation by a jury of specialists in science education and of biology teachers of a list of principles of biological science for use in high school biology courses. (2) Evaluation by a jury similar to the first of activities related to the 152 principles found in the first part of the study to be of greatest importance for such courses.

Sources of Data.--Expert judgments and checklists.

Statistical Treatment.--Mean and comparison of frequencies.

Major Findings.--(1) Five hundred fifty-eight assignments of activities were ideally or well suited to developing an understanding of 93 principles of biological science of greatest importance for general education in high school biology courses. (2) Sixty-nine or 12.3 percent of the 558 acceptable activities were ideally suited to contributing to an understanding of the principles to which they were related and 489 or 87.6 percent were well suited for such purposes. (3) The 93 principles remaining in the list after duplicates were eliminated had an average of six activities which were ideally or well suited to developing an understanding of them and an average of 0.7 which was ideally suited. (4) Thirty-eight principles or 40.9 percent of the list of 93 had at least one activity assigned which was ideally suited for developing an understanding of them, whereas 55 or 59.1 percent had none. Ninety principles or 96.8 percent had at least one activity which was well suited or better, while 3 or 3.2 percent had none. (5) For 18 or 11.8 percent of the principles in the list of 152, no activities were found in the sources examined which might reasonably be expected to contribute to their understanding. Moreover, three other principles or 1.9 percent of this number had no activities which were ideally or well suited for such purposes. Consequently, a total of 21 or 13.8 percent of the original 152 principles had no activities which were acceptable for use in high school biology courses. (6) Two hundred seventy-three or 48.9 percent of the acceptable activities would more appropriately be performed as demonstrations, 231 or 41.4 percent as individual laboratory experiments, and 54 or 9.1 percent equally well by either method.

****

MALLINSON, GEORGE GREISEN. Some Problems of Vocabulary and Reading Difficulty in Teaching Junior High School Science. Non-thesis, 1952, Western Michigan College of Education. 6 p. Author, Western Michigan College of Education, Kalamazoo, Michigan.

Problem or Problems.--The purpose of this study is to examine the various research studies that deal with levels of reading difficulty of textbooks in science for junior high school in order to determine whether or not they are too difficult.

Steps or Methods.--A search of the literature was made of all the research studies that had been carried out with respect to the levels of reading difficulty of textbooks in junior high school science. The findings of these studies were tabulated and general summaries were made of them. From these findings, recommendations were made for the publication of textbooks.

Sources of Data.--Reference books and periodicals.

Statistical Treatment.--None.

Major Findings.--(1) Before a textbook is actually written, it may be well for the author or publisher to search the literature to obtain lists of words or terms that are essential or desirable for inclusion in a course for junior high school science. If such lists are not available, the time required to prepare them may be well expended. These words, when they appear in the textual material, should be explained clearly and, if above the vocabulary level of the students, should be pronounced and defined. Further they should be used in the textbook several times in different contexts so as to give the student additional opportunities to experience them. (2) Difficult non-technical words should be replaced with easier synonyms, unless absolutely impossible. In the writer's analysis of textbooks, it was found that many non-technical words could have been replaced with easier synonyms. If it becomes necessary to use a difficult non-technical word, it should be listed with phonetic spellings and with a clear statement of its meaning. (3) Authors and publishers should bear in mind that half the students in any class are below average. Hence it may be well to select a vocabulary that is from one to one and one-half grade levels below that of the grade in which the book is to be used. (4) For the better students it may be possible to include paragraphs or topics for individual study in which the levels of reading difficulty are commensurately higher. In this way it may be possible to provide somewhat for individual differences in reading ability. (5) Although there is frequent criticism that books are too large and hence more expensive than is desirable, it may be well to devote additional space for the inclusion of an adequate glossary. The glossary might contain the essential, desirable and difficult words together with their spellings. It may be well also to list such words at the ends of the chapters in which they appear. Thus, the teacher will be saved much time in preparing lists of words that may be stumbling blocks to or worthy of additional study by the students.

****

MALLINSON, GEORGE GREISEN, STURM, HAROLD E., and MALLINSON, LOIS MARION. The Reading Difficulty of Textbooks for General Science. Non-thesis, 1952, Western Michigan College of Education. 5 p. Author, Western Michigan College of Education, Kalamazoo, Michigan.

Problem or Problems.--The purpose of this study was to analyze textbooks of general science in order to determine whether their levels of reading difficulty were higher than might be desirable.

Steps or Methods.--(1) All the textbooks in general science were obtained, and it was decided to select for analysis from each textbook one sample page for each 100 pages or fraction thereof, but not less than five pages from any one textbook. (2) The samples were selected from the textbooks by means of a table of random numbers. (3) The samples were then analyzed for reading difficulty by means of the Flesch formula. The significances of the differences between the lowest and highest textbooks with respect to reading difficulty were determined.

Sources of Data.--Textbooks.

Statistical Treatment.--Fisher's "t."

Major Findings.--(1) The levels of reading difficulty of passages within the separate textbooks vary greatly. The easiest passage in the textbook of Publisher B has a grade level of difficulty of Grade V completed; the most difficult passage, of Grade VIII. The easiest passage in the textbook of Publisher P has a grade level of difficulty of Grade VI completed; the most difficult, of college completed. If these two are representative of the variations of levels within a book, it is clear that in any textbook some passages are not likely to cause difficulty for any of the students for whom they are designed but that other passages are likely to cause difficulty for some students, as in the case of Publisher B; and for all students, as in the case of Publisher P, for whom they are designed. Further, it is clear that the average reading-difficulty score for a textbook may be somewhat misleading. Some textbooks that have many extremely difficult passages may be balanced by some very easy passages. (2) The grade levels of difficulty of the textbooks vary greatly. The easiest textbook has a level of difficulty of Grade VI completed. It is unlikely that this textbook will prove difficult for many students whether the book is used in Grades VII, VIII, or IX. Further, the most difficult textbook with a level of difficulty of Grade X is likely to be difficult to read for all but the best students at whatever level general science is taught. (3) As compared with series of textbooks for junior high school science, textbooks for general science that are designed for essentially the same grade levels have a much greater range of reading difficulty. As a group, series of textbooks for junior high school science range in level of difficulty from Grade VI completed to Grade VIII completed. Those for general science range from Grade VI completed to Grade X. (4) As with the textbooks for areas of science other than general science, the earlier passages in general science textbooks do not seem to be consistently lower in level of reading difficulty than the later passages. Hence, no apparent provision is made for growth of reading ability during the year or years in which the books are used. (5) The books tend to fall into three categories with respect to difficulty. The easiest quarter (four textbooks) is significantly less difficult than the middle half (eight textbooks). The middle half is significantly less difficult than the most difficult quarter (four textbooks). Further, there are significant differences in levels of difficulty between (a) the easiest textbook and all the others, (b) the easiest half and the most difficult half, and (c) the easiest and the most difficult textbooks. (6) It seems reasonable to state from the conclusions already listed that the differences found make level of reading difficulty a valid criterion for use in the selection of a textbook. (7) In view of the levels of reading difficulty, it may be concluded that many of the textbooks now in use for general science are more suitable for use at the ninth-grade level than at the seventh- and eighth-grade levels. Hence, certain adjustments need to be made in textbooks if they are to conform with the trend of "moving general science" into Grades VII and VIII. It is recognized that the rather marked trend away from using two books in Grades VII and VIII is likely to continue. Hence, single textbooks for general science need to be written with lower levels of reading difficulty so as to be suitable for use in these two grades.

****

MALLINSON, GEORGE GREISEN, STURM, HAROLD E., and MALLINSON, LOIS MARION. The Reading Difficulty of Textbooks for High-School Physics. Non-thesis, 1952, Western Michigan College of Education. 5 p. Author, Western Michigan College of Education, Kalamazoo, Michigan.

Problem or Problems.--It is the purpose of this study to evaluate textbooks for high-school physics with respect to their levels of difficulty.

Steps or Methods.--(1) All the textbooks in high-school physics were obtained, and it was decided to select for analysis from each textbook one sample page for each 100 pages or fraction thereof, but not less than five pages from any one textbook. (2) The samples were selected from the textbooks by means of a table of random numbers. (3) The samples were then analyzed for reading difficulty by means of the Flesch formula. The significances of the differences between the lowest and highest textbooks with respect to reading difficulty were determined.

Sources of Data.--Textbooks.

Statistical Treatment.--Fisher's "t."

Major Findings.--(1) The textbooks (eleven in number) whose grade level of reading difficulty is ninth grade completed or below (difficulty score below 4.5) are not likely to be difficult for the average eleventh- or twelfth-grader taking physics. Neither are they likely to cause great difficulty for the below-average student. This conclusion does not apply to individual passages that are difficult. (2) The textbooks (three in number) whose grade level of reading difficulty is between ninth grade completed and tenth grade completed (difficulty score -- approximately 4.5 to 4.75) are not likely to be difficult for the better student, are not likely to cause great difficulty for the average student, but are likely to be difficult for the less able student. (3) The textbooks (two in number) whose grade level of reading difficulty is high school completed or higher are likely to be difficult for even the superior student. The most difficult textbook seems to be above the level of comprehension of even some college students.

****

MALLINSON, GEORGE GREISEN, and VAN DRAGT, HAROLD. Stability of High School Students' Interests in Science and in Mathematics. Non-thesis, 1952, Western Michigan College of Education. 6 p. Author, Western Michigan College of Education, Kalamazoo, Michigan.

Problem or Problems.--The purpose was to determine whether the interests of high school students in these fields of study are sufficiently stable over the high school period to be used as a basis for guidance and counseling.

Steps or Methods.--(1) Kuder Preference Record, Form BB, was administered to 240 high school students at the ninth grade level and again to these same students after they had completed at least three years of high school. The raw scores and the relative ranks of these scores for the areas of science and mathematics were then compared with one another in order to determine the extent to which interests in these areas were stable between the two grade levels at which the tests were administered. (2) The methods used in making the comparisons were (a) percentage of cases in which the raw scores remained the same, (b) percentage of cases in which the ranks remained the same, (c) coefficients of correlation between the raw scores of the tests as given at both levels, as well as the ranks of the raw scores, (d) coefficients of alienation were determined for all these coefficients of correlation.

Sources of Data.--Experimental groups.

Statistical Treatment.--Coefficient of correlation and coefficients of alienation.

Major Findings.--(1) The data indicate that, to a great extent, if interest in science or interest in mathematics ranks high in Grade IX, it is still likely to rank high in Grade XII. However, one is not justified in assuming that it will remain in the same rank. Students who are guided into science or into mathematics at Grade IX, or into curriculums emphasizing science or mathematics, may find themselves more interested in music, social science, or some other area of study at Grade XII. The guidance, therefore, may be chiefly "misguidance." (2) Overall predictability is not high insofar as scores or ranks at Grade IX are related to those at Grade XII. Coefficients of alienation are greater than coefficients of correlation. (3) This study fails to substantiate claims that interest is likely to be a reliable predictor of talent in individuals.

****

MANEY, ETHEL SWAIN. Literal and Critical Reading in Science. D.Ed., 1952, Temple University. 130 p. Library, Temple University, Philadelphia 22, Pennsylvania.

Problem or Problems.--(1) What is the relationship between literal and critical reading comprehension of science materials? (2) What is the relationship between verbal intelligence and (a) "survey" or "general" reading comprehension? (b) literal reading comprehension in science? (c) critical reading comprehension in science? (3) What is the relationship between reading comprehension as measured by a standardized reading survey test and that appraised by (a) a literal reading test in science? (b) a critical reading test in science? (4) To what degree does each selected critical reading skill tend to be independent of the ability to read literally when science materials are used?

Steps or Methods.--(1) A full statement of the problem with justification of the study, limitations, and terminology is given. (2) A review of kindred literature using the subjective approach, the experimental approach, and test construction follows next. (3) The construction of the test from the standpoint of planning, preparing, and evaluating the test. (4) The preliminary study of the limitations, results, conclusions, and outcomes using the experimental design, the statistical design, and population. (5) The procedure for the population with criteria and screening procedure plus statistical procedures used. (6) The evaluation of the experimental edition as to reliability and validity. (7) The results of the inter-test relationships and the intra-test relationships. (8) The conclusions and implications to the problem and suggestions for further research. (9) A bibliography and appendices giving supporting data and standardized tests.

Sources of Data.--Reference books, periodicals, textbooks, manuals, charts, and research studies.

Statistical Treatment.--Coefficient of correlation, Chi square, inter-correlation and point-biserial correlations.

Major Findings.--(1) There is a high relationship between verbal intelligence and proficiency in literal reading in science. (2) There is a substantial relationship between verbal intelligence and proficiency in critical reading in science. (3) There is a high relationship between general reading comprehension and literal reading comprehension of science materials. (4) There is a substantial relationship between general reading comprehension and critical reading comprehension of science materials. (5) Critical reading comprehension in science is a complex of skills or abilities, each of which is relatively independent of the ability to read literally. (6) Proficiency in critical reading of science materials cannot be predicted from scores obtained (a) on literal reading tests in science, (b) on group tests of verbal intelligence, or (c) or general reading tests. (7) Proficiency in literal reading interpretation may be predicted with a fair degree of accuracy from scores on group tests of verbal intelligence and general reading tests. (8) Group tests of verbal intelligence and general reading tests tend to measure many common abilities.

****

MERRILL, WILLIAM ERNEST. A Proposal for Science in the Education of Elementary Teachers at Radford College. D.Ed., 1952, Columbia University. 63 p. Library, Teachers College, Columbia University, New York, New York.

Problem or Problems.--What is desired in an educational program in science for elementary teachers? What kind of laboratory work is most suitable for elementary teachers? How can the campus and the surrounding area be used for study? How much and what kind of subject matter can be used? To what extent should the course be professionalized? How can the laboratory school be used in the science program?

Steps or Methods.--The needs of Radford College were studied by the faculty, through recommendations of the College President and others. The role of science in a college program for elementary teachers was shown by a study of literature, books, etc. and the advice of leaders in elementary science education. A study was made of opportunities for science instruction at Radford College. This included suggestions for selecting materials for the course as well as methods of using them. Recommendations were made for the course at this particular College.

Sources of Data.--Reference books, periodicals, expert judgments, textbooks, courses of study, and questionnaires.

Statistical Treatment.--None.

Major Findings.--The content should emphasize the functional and social aspects of science in the lives of teachers as individuals and as instructors. The content should be selected from the various compartments of science without regard to lines of division. Principles, facts, and generalizations should be associated with everyday activities, and community resources should be used for study and example. The course should provide for directed study, for observations of children at work and play, for activities that produce specific skills, habits and attitudes, and for methods which may be used by future teachers. The laboratory and field activities should be conducted in such a way as to show the how, the when, and the what of science in the elementary school. In other words, science for elementary teachers should be a combination of appropriate subject matter and methods of teaching which will develop effective teachers who are secure in their knowledge of children, of science, and of appropriate methods.

****

MILLER, DAVID JOHN and MALLINSON, GEORGE GREISEN. An Investigation of the Attitudes of Teachers Toward the New York State Regents' Examinations in Science. Non-thesis, 1952. 13 p. Author, Lakeview Junior High School, Battle Creek, Michigan.

Problem or Problems.--The purpose of this study is to determine the attitudes of the science teachers of the State of New York with respect to the Regents' Examinations in Science.

Steps or Methods.--(1) An exhaustive search was made of the literature concerning desirable objectives of science. As a result the objectives listed in the Forty-Sixth Yearbook of the National Society for the Study of Education were accepted as desirable standards against which to measure the Regents' Examination. (2) A tentative form of the questionnaire was then prepared. After criticisms, a final form was prepared. (3) The next step was to send questionnaires to two groups of teachers: (a) Teachers who are now teaching "Regents" science in New York State but who formerly taught science in other States and countries. They are referred to as "out-staters." (b) Teachers whose experience in teaching "Regents" science has been only in New York State. They are referred to as "in-staters." (4) A letter was then sent to the science teachers of New York State asking for the names of the various persons who had taught in other States. Questionnaires were sent to all of them. (5) A list of names of all the science teachers in the State of New York was obtained. It was decided to send questionnaires to a representative sampling of six hundred teachers on the list.

Sources of Data.--Questionnaires.

Statistical Treatment.--Percentages.

Major Findings.--(1) Syllabi were available for all the science courses investigated in this study. Apparently teachers are satisfied that, if the courses are taught in accord with the outline of the syllabi, the examinations prepared for the courses are likely to be reasonable. (2) Teachers believe that the Regents' are better devices for evaluating the achievement of college-entrance students than that of the non-college students who are headed for the farm or technical industries, or for that matter for the non-college student who takes science for its general cultural value. (3) Teachers are of the opinion that the Regents' examinations are better measures of factual achievement than of understanding of science. (4) Both teachers and students tend to be more concerned with the passing of the Regents' examinations than with the students learning about science. (5) The teachers of science believe that the examinations are good measuring devices for the majority of students. (6) The Regents' restrict teachers in what they would like to teach. The majority of out-staters expressed no positive belief that the science courses they taught in other States were more practical than those they were teaching in New York State. (7) In general, a majority of in-staters indicated that they did not believe the Regents' system restricted them in what they wished to teach. (8) The teachers polled in this study believed that the students of New York State attain the same or a higher level of achievement than students in other States, insofar as the major objectives of the teaching of science are concerned. (9) More than half of the teachers believe that the abolition of the Regents' examinations will reduce the standards of science teaching in the State of New York. About another quarter believe that the abolition will produce no change in standards. The rest of the respondents to the question believed that standards would be raised by this abolition. (10) Nearly 90 percent of the teachers wish to retain the Regents' examination although a little more than two-thirds believed that their construction and use might well be modified. Only 10 percent believe that they should be discarded. (11) If the examinations were modified according to the suggestions made by the respondents, more than two-thirds would approve their retention. The rest of the respondents expressed no opinions, since many of them made no suggestions for modifications. (12) About two-thirds of the respondents expressed the desire that a scoring key be provided with the respective examinations. (13) Over three-fourths of the teachers believe that the teachers passing percentage should not be reported to the State. This is in accord with present policy although many believe erroneously that the State keeps such records. (14) Nearly two-thirds of the teachers desire that the State recheck a sampling of the papers that the teachers have scored and forwarded to the State. About one-third expressed themselves against such a policy. (15) Nearly four-fifths of the teachers believe that the examinations should be subject to the call of the State. About one-half of these would keep the papers in the school unless they were called for.

****

MILLIKAN, GUY. The Adequacy of Chemistry Laboratories in Class "C" Schools of Michigan. M.A., 1952, Ball State Teachers College. Library, Ball State Teachers College, Muncie, Indiana.

Problem or Problems.--The purpose of this study was to determine the adequacy with which chemistry laboratories in class "C" high schools of the State of Michigan are equipped for teaching chemistry and to determine how extensively the course of chemistry is being offered to students in these schools.

Steps or Methods.--The questionnaire method was chosen for this study. A letter accompanying the questionnaire was addressed to the science instructor in each school. As the completed questionnaires were returned, the answers were tabulated and analyzed.

Sources of Data.--Questionnaires.

Statistical Treatment.--Comparison of frequencies.

Major Findings.--This study shows that the chemistry laboratory facilities in class "C" high schools of the State of Michigan are in general considered adequate by the chemistry teachers. The study shows that nearly all (99 percent) class "C" schools offer chemistry, that nearly all (98 percent) of these teach it with laboratory work which 96 percent of the teachers feel is essential for satisfactory chemistry instruction.

****

MORLONG, ORRIE. Some Phases of Elementary Science in Eleven Counties in Kansas in 1951-52. M.S., 1952, Kansas State Teachers College. 47 p. William Allen White Library, State Teachers College, Emporia, Kansas.

Problem or Problems.--How much time was devoted to the teaching of science in the elementary grades? What was the college science preparation of the teachers of elementary science?

Steps or Methods.--A representative sample of eleven counties was selected for study. Each county was visited. The program of each teacher in the county was examined. The transcript of each teacher was examined.

Sources of Data.--Interviews, first-week reports of teachers, and transcripts of teachers. The study included 301 rural teachers, 264 graded 1-8 teachers, and 141 graded 1-6 teachers.

Statistical Treatment.--None.

Major Findings.--Sixty-five percent of the rural pupils, 79 percent of the graded 1-8, and 55 percent of the graded 1-6 pupils were enrolled in science. Forty-eight percent of the graded 1-6 teachers, 20 percent of the 1-8, and 12 percent of the rural teachers had 120 or more college semester hours of credit. Seventy-two percent of the rural teachers, 63 percent of the graded 1-8, and 51 percent of the graded 1-6 teachers had less than 6 semester hours of college science.

****

MUDGE, JOHN EMERSON. The Feasibility and Present Usage of the Senior Advanced General Science Course in High School. M. S., 1952, Cornell University. 84 p. Nature Study Department, Cornell University, Ithaca, New York.

Problem or Problems.--The study is concerned with modified science subjects related to the secondary school curriculum as a means of stressing constructive thinking, the securing of some pertinent data, and the presenting of various opinions of those in the field.

Steps or Methods.--(1) Review of the activities of the National Society for the Study of Education and of many branch organizations of the National Education Association. (2) Consultation with State and federal bureaus of education and review of material dealing with curriculum organization published by these agencies. (3) Textbooks dealing with secondary education, periodicals, letters from teachers in the field. (4) Survey by questionnaire of some senior science courses presently taught.

Sources of Data.--Reference books, periodicals, and questionnaires.

Statistical Treatment.--None.

Major Findings.--The senior science that is in most widespread use is of the survey type, a course that attempts to draw from the personal experiences of the students. Attempts are being made to gear the subject to the community and its youth. Particular emphasis has been given to consumer education. Other senior science courses are obviously designed to occupy the disinterested students' time. The courses are comparatively new, most having been introduced since the war.

Suitable texts are not available for either the survey senior science or the advanced general science courses, and this lack was mentioned by high school personnel as a serious factor in presenting a senior science course. Several steps are necessary before the advanced general science course can be adopted. The community must be willing to offer the use of its facilities, the school and the teacher must believe in the values of the course, and teachers must be prepared in general science.

An advanced general science course must achieve the following goals: Reduce the fear of science, enlarge the group of potential scientists and technicians, and assist the student in making vocational choice.

****

NATH, LAWRENCE H. The Influence of Selected Factors on Science Instruction in the Public High Schools of Kentucky. Ph.D., 1952, University of Kentucky. 184 p. Library, University of Kentucky, Lexington, Kentucky.

Problem or Problems.--The major problem of the study was to study the influence of selected factors on the science instruction in the high schools of the State. Certain factors were selected as those essential. These were determined from a study of the literature extent and included (1) the teacher, (2) the laboratory, (3) adjuncts to science instruction, and (4) curriculum, objectives, and procedures.

Steps or Methods.--A short questionnaire, very similar to that used by the U. S. Office of Education in The Teaching of Science in the Public High Schools, 1950, was sent to all 444 high schools listed in the Kentucky Public Schools Directory, 1950-51. A representative sampling of those returning the questionnaire were visited and studied intensively, using a nine-page schedule of information for data to be secured from each. Seventy schools were studied. The data were then collated, analyzed, and conclusions drawn.

Sources of Data.--Interviews, expert judgments, questionnaires, and study of schools by personal visit.

Statistical Treatment.--Mean, median, and comparison of frequencies.

Major Findings.--(1) The quality of science instruction in the high schools of the State of Kentucky is poor. The pre-service training of almost all of the science teachers has been highly specialized in given science fields. Since most of the science teachers in the State are required to teach in all the science fields, this specialization creates a weakness in the instruction phases beyond the teachers' specializations. The lack of the science training over the major science fields and their lack of training in methods of teaching science are factors which have a direct bearing on the poor quality of science instruction extent in the high schools. (2) The pre-service training of Kentucky high school science teachers has been very good and, therefore, cannot be considered as a factor in the poor quality of science instruction. (3) The science teachers are not professionally minded. Few belong to professional organizations and few attend professional meetings. (4) The teacher load is too heavy for even the possibility of effective science teaching. Class size is low. (5) Laboratory facilities are inadequate, equipment and materials poor and in low supply. Budgetary allotment for science programs are very low and, in some cases, nonexistent. (6) Programs for enrichment of science programs indicate a need for improvement. More science clubs need to be organized, the use of audio-visual materials needs to be extended, and teachers need to be better informed on efficient use of these materials. Library facilities and supplies need to be improved. (7) Science teachers need to formulate clearly their objectives and their philosophies of science instruction, and plan effectively to meet their objectives. (8) Pupil-teacher relationships need improvement. Pupil-teacher planning is not being effected. The needs of youth and the needs of the individual pupil are seldom taken into account in planning the science programs. (9) Teacher preparation programs in the State colleges and university are not designed to prepare the science teachers for actual conditions under which they must work. (10) Little or no use is being made of community resources. (11) Conservation is being taught only in conjunction with the agricultural program. The horizons in this area need to be expanded.

****

NUSSBAUM, ELMER. A Simplified Cloud Chamber for the Physics Laboratory. M.A., 1952, Ball State Teachers College. Library, Ball State Teachers College, Muncie, Indiana.

Problem or Problems.—The problem is to simplify cloud chamber apparatus and incorporate in it such components as are readily available to any experimenter. The report should be complete enough so that results can be duplicated in the average laboratory.

Steps or Methods.—Pertinent materials were read in libraries. Letters were written to experimenters who had used cloud chambers similar to the one under consideration. The physical laboratories and equipment of some schools were made available for experimentation. Conferences were held with the adviser.

Sources of Data.—Expert judgments and laboratory experiments.

Statistical Treatment.—None.

Major Findings.—The simple chamber as described can be one of the most fascinating demonstration devices in the physics laboratory. The cost of operation is limited to the dry ice and the alcohol. It is believed that this simplified cloud chamber will enhance the teaching and demonstration possibilities of the high school and small college laboratories.

****

OLESON, LYLE. Abilities of General Science Students with Respect to Four Objective Types of Tests. M.A., 1952, Ball State Teachers College. Library, Ball State Teachers College, Muncie, Indiana.

Problem or Problems.—The purpose of this study was to determine how well four objective types of tests evaluate the abilities of general science students; how well the scores in these tests correlate with the course grade; and if the interrelationship of those types of tests is such that the types can be used singularly. A secondary objective of the study was to determine how well the scores in each of the types of tests correlated with the students' reading ability.

Steps or Methods.—The experiment was conducted with the freshmen general science classes. The objective types of tests were given throughout the year to minimize any variable factor such as time of year, illness of students, weather, and outside disturbances.

Sources of Data.--Experimental groups.

Statistical Treatment.--Mean and Chi square.

Major Findings.--The course grade and the true-false test shows a good degree of relationship. The coefficient of correlation of the course grade with the multiple choice test shows a high degree of relationship. The coefficient of correlation of the course grade with the completion test shows a very high degree of relationship. From the findings of this research, it appears that all of the types of the tests used will fairly well determine the course grade.

****

PERELLI, DOREEN LESLEY. The Development and Educational Value of the West Rock Nature Center in New Haven, Connecticut. M.S., 1952, Cornell University. 48 p. Nature Study Department, Cornell University, Ithaca, New York.

Problem or Problems.--To summarize the origin, development, and operation of the West Rock Nature Center, New Haven, Connecticut, as a background for the development of a field guide to learning activities which elementary teachers might carry on with their pupils.

Steps or Methods.--First-hand knowledge of the facilities and possibilities of the Nature Center was acquired by the author through visits to the Center, use of its facilities in work with elementary school children, and contact with the director.

Sources of Data.--Interviews and personal exploration.

Statistical Treatment.--None.

Major Findings.--A list of graded studies and activities is presented as a guide to teachers whose lack of background in science makes it difficult for them to recognize and utilize the teaching and learning opportunities provided by the Nature Center. Application of the nature center idea in other communities is suggested.

****

PETERSON, PETER VICTOR, JR. A Preliminary Study of the Opportunities Presented by Fresh-water Streams as Laboratories for Pre-college Science and Conservation Programs. Ph.D., 1952, Cornell University. 224 p. Mann Library, Cornell University, Ithaca, New York.

Problem or Problems.--The use of streams as outdoor laboratories to help tie down and to demonstrate many of the pre-college science and conservation principles which are met in the pre-college curriculum.

Steps or Methods.--After having chosen the area, the author carried out studies of flora and fauna and gathered physico-chemical data. The studies were illustrated and explained. Included were: enumeration of factors which affect a moving fresh-water habitat, presentation of methods of measuring these various factors and of presenting data, and sample lessons and other suggested means of conveying this information to the student. In addition, there was correlation of scientific data to provide suggestions for aiding pre-college students to understand and appreciate more fully moving wet areas in terms of biological, conservational, and aesthetic principles and values.

Sources of Data.--Personal investigation of the area, reference books, and periodicals.

Statistical Treatment.--None.

Major Findings.--The ecological viewpoint is stressed; however, the methods used are not those of a professional ecological study. Simple techniques are described for the collecting of pertinent physico-chemical and biological data using equipment which is inexpensive and easily constructed. This provides for worthwhile projects in simple construction that fit within the budgets of secondary schools.

These show that a fresh-water stream can be used as an outdoor laboratory to present many principles encompassed in pre-college science and conservation programs. The interrelationship among some of the factors affecting a moving fresh-water habitat was developed. Some problems concerned with water pollution and purification were treated. Related topics such as geology, soil study, and water power development were included as further examples of how a stream and surrounding area can be effectively used as a teaching vehicle.

****

RANKIN, OREN RAYMOND. A Study of Competencies Desirable for Instructors of College General Education Courses in Physical Science. Ed.D., 1952, University of Illinois. 114 p. Library, University of Illinois, Urbana, Illinois.

Problem or Problems.--The study involves an attempt to obtain opinions and data which may serve as a beginning in looking at the problems involved in the selection and preparation of teachers for physical science in college general education.

Steps or Methods.--Two forms of a questionnaire were used -- one to be filled out by administrators of general education programs and the other by instructors of general education physical science courses. A total of 496 usable questionnaires was returned from 42 States, the District of Columbia, and Puerto Rico. There were 148 administrator's forms and 348 instructor's forms returned from 184 colleges and universities.

Sources of Data.--Questionnaires.

Statistical Treatment.--Mean and comparison of frequencies.

Major Findings.--If the hopes of those concerned with developing adequate programs of general education are to be realized and the fears of the critics of the program are to be expelled, increasing attention must be directed toward the training of teachers in a manner to develop those competencies which are desirable to achieve the goals of general education. The opinions of the instructors and administrators who cooperated in this study seem to indicate a need for broader learning at the graduate level for those who are preparing to teach physical science in college general education. These opinions also indicate a need for more training in how to teach. Further studies are needed to determine more exactly the elements of a desirable graduate program for teachers of physical science in general education and teachers in other areas of general education. Studies of this type might well be made to determine the extent to which the present graduate program serves the needs of the teachers in the specialized areas of college training.

* * *

REID, ROBERT WAYNE. An Analysis of the Understanding of Certain Atomic Energy Concepts by Fourth, Fifth, and Sixth Grade Students. Ed.D., 1952, Colorado State College of Education. 110 p. Library, Colorado State College of Education, Greeley, Colorado.

Problem or Problems.--(1) How many of a selected list of concepts, as measured by the mean scores, do (a) fourth grade, (b) fifth grade, and (c) sixth grade children understand before receiving instructions about them? (2) How many of a selected list of concepts, as measured by mean scores, do (a) fourth grade, (b) fifth grade, and (c) sixth grade children understand after receiving instruction about them? (3) Does a certain procedure of instruction help elementary children understand certain designated atomic energy concepts? By understand the writer means that the children should be able to correctly complete certain written statements about atomic energy. Concepts are defined by the writer as any word, phrase, or sentence concerning atomic energy. (4) What specific parts or areas of atomic energy are understood by the children?

Steps or Methods.--Fifty atomic energy concepts identified by help of pilot group of children were selected for the basis of this study. Control and experimental groups were selected from two public schools in Greeley, Colorado. Multiple choice type tests were then given each group on the concepts selected. The tests were standardized by three recognized authorities in the fields of science and education. Special instruction was given in five areas of atomic energy based upon frequency of use by the pilot group: (1) atom, (2) atomic fission, (3) atomic pile, (4) atomic power, and (5) tagged atoms. Differences in understanding between the two groups were tested for in each of the schools. The data were then treated statistically for interpretation.

Sources of Data.--Experimental groups and control groups.

Statistical Treatment.--Mean, median, standard deviation, coefficient of correlation, and comparison of frequencies.

Major Findings.--It seems possible that, under certain conditions, many children understand much about the technical aspects of atomic energy. Children in fourth, fifth, and sixth grades who cooperated in this study made significant gains as measured by a multiple choice test after certain prescribed instruction. Groups of children of these grade levels also tended to show a definite correlation between the measured ranking before and after instruction. Grade group means showed little change between the pre-test and final test results for the control groups. The experimental groups all showed statistically significant gains.

Groups seemed to gain and show more understanding with added maturity. Grade six children, generally, made the highest scores. They were closely followed by grade five children. Grade four children seemed to experience much more difficulty than those of the other two grades. The area "Tagged Atoms" as presented seemed to give the children the greatest amount of difficulty. The areas of atomic fission and the atom gave them, as a group, the least difficulty. On the basis of this study, it seems reasonable to assume that many children, particularly in grades five and six, under certain method of instruction, can benefit from technical atomic energy instruction.

****

ROE, HOWARD EARL. The Organization of Source Materials in the Field of Biology as a Basis for the Development of Resource Units of Work for High Schools in the State of Washington. Ed.M., 1952, University of Washington. 81 p. Library, University of Washington, Seattle 5, Washington.

Problem or Problems.--The development of resource units in the field of biology.

Steps or Methods.--Resource units were developed that emphasized the use of the local community resources.

Sources of Data.--Reference books, periodicals, textbooks, courses of study, and expert judgments.

Statistical Treatment.--None.

Major Findings.--Not reported.

****

RUTH, ALICE KEARNEY. Science Concepts of Sixth Graders. M.A., 1952, Queens College. 10 p. Education Department, Queens College, Flushing, Long Island, New York.

Problem or Problems.--To measure science concepts of sixth graders and to evaluate present curriculum in elementary science.

Steps or Methods.--(1) Searched literature of research for previous research. (2) Composed test based on science experiences of sixth graders. (3) Administered test to seventy-two sixth graders in my school. (4) Determined social level of children through Warner formula. (5) Compiled tables based on Intelligence, Reading Level, Social Class, Sex, and Scores. (6) Computed average and median for each table. (7) Analyzed validity of questions in test. (8) Prepared conclusions. (9) Determined educational implications of this study.

Sources of Data.--Tests.

Statistical Treatment.--Median.

Major Findings.--Higher scores in science can be attained by (1) children with better than average intelligence; (2) children with reading level which is up to their grade; (3) children who come from middle to upper class families; (4) boys as compared with girls. Precautions must be taken by the teacher of elementary science to include in the curriculum such a variety of experiences as will reach all of these groups if a full concept is to be arrived at by all the children.

****

SAILORS, MARY B. Some Steps in Building a Meaningful Science Program for the Elementary School. M.A., 1952, Ball State Teachers College. Library, Ball State Teachers College, Muncie, Indiana.

Problem or Problems.--The purpose of this study is to build an elementary science program that will help the child to understand many of the things that arouse his curiosity. The writer has hoped to build a science program in which the subject matter is not too difficult for the child to understand and one which still provides activities that will develop scientific thinking.

Steps or Methods.--All of the material in this science program has been used in an actual classroom situation. Some of the units have been taught several times in the same grade. Some of the same units have been taught to pupils of different grade levels.

Sources of Data.--Experimental groups.

Statistical Treatment.--None.

Major Findings.--It would seem that there is a tendency to include more science work in the elementary curriculum. Teachers will be able to use scores of opportunities for integrating science with other fields of study.

****

SHAWVER, BENJAMIN THOMAS. College Science for General Education: Planning for Science Teaching in a Liberal Arts College. Ed.D., 1952, Columbia University. 209 p. Library, Teachers College, Columbia University, New York, New York.

Problem or Problems.--The purpose of this study was preparation to continue teaching science in a liberal arts college. The problem of determining an adequate program of science education for college students grew out of experiences had while engaged in the teaching of chemistry at Monmouth College, Monmouth, Illinois.

Steps or Methods.--The method used in the study was a study of relevant literature in the area of science education and the history of higher education. Study of the latter was undertaken to gain perspective with respect to the development of the curriculum at Monmouth College and in similar institutions. Literature in the area of science education was reviewed to become acquainted with practices which take into account preparation for successful living in the world of today. Considerable attention was devoted to the development of guiding principles for the planning of science education and the philosophical basis therefore.

Sources of Data.--Reference books, periodicals, and letters from college science teachers.

Statistical Treatment.--None.

Major Findings.--The recommendations included the following: (1) Make planning of science education a divisional affair; (2) Organize advisory committees to participate in the planning; (3) Take into account in the planning the developmental tasks of young people, improvement of health, extension of natural resources, improvement of human relations, and a broader base for vocational specialization; (4) Enrich the guidance program through in-service training; (5) Extend the follow-up program to include all alumni at the level of reactions to college training in light of further training and work experience; (6) Provide a general course in science for all students built around problems identified by and agreed upon by the individuals concerned; and (7) Provide an interdepartmental seminar for seniors majoring in one of the sciences and staff members from the division of natural science.

****

SHAWVER, MURL CHARLES. Development of a Plan for a Two-Semester Course in the Biological Sciences for Madison College, Harrisonburg, Virginia. Ed.D., 1952, Columbia University. 166 p. Library, Teachers College, Columbia University, New York, New York.

Problem or Problems.--The major problem was to develop a course of study in the biological sciences, in the light of general education objectives, to be offered as part of a core curriculum required of all students at Madison College, Harrisonburg, Virginia. Considerable attention was also given to the practical problems related to the placing of the course in effect at Madison College.

Steps or Methods.--(1) The catalogs of 420 selected institutions were examined to ascertain the nature of introductory courses in biology insofar as this may be done from catalog descriptions. (2) The eleven objectives of general education listed in the Report of the President's Commission on Higher Education were accepted as a satisfactory set of general objectives for a program of general education in a college. (3) An interest questionnaire was devised and administered to obtain student reactions. (4) An analysis was made of the teaching possibilities afforded by the Madison College community. (5) A study was made of the available teaching aids in the community.

Sources of Data.--Reference books, periodicals, textbooks, courses of study, expert judgments, and college catalogs.

Statistical Treatment.--None.

Major Findings.--(1) Four common areas of human experience were identified as requiring contributions from the biological sciences: (a) Personal and Community Health, (b) Mental Health, (c) Home and Family Living, and (d) Man and His World. It was postulated that common problems in these areas could be identified by Madison College students. (2) Public health in Virginia was found to provide a number of community problems that the students identified as related to the contemporary scene. (3) In the light of existing trends, the general education proposals of Madison College, the general objectives which were accepted, the evidences from student interests, and the existing instructional resources of the community, a course of study in biology for general education was formulated.

****

SIEBRING, BARTELD RICHARD. A Study of the Influence of Institutional Environment in the Training of Professional Chemists. Ph.D., 1952, Syracuse University. 261 p. Library, Syracuse University, Syracuse, New York.

Problem or Problems.--What type of institutional environment is the most successful in the training of chemists?

Steps or Methods.--(1) A description and analysis of the previous studies which attempted to determine which type of institutional environment has been the most successful in training chemists. (2) Determining by institution the proportion of the 1932-1941 baccalaureate chemistry graduates which earned the chemistry or biochemistry Ph.D. in the 1936-1945 decade. The baccalaureate origin of the 1936-1945 chemistry and biochemistry doctorates was obtained. The number of baccalaureate chemistry graduates by institution was obtained by questionnaires sent to the heads of the respective chemistry departments. (3) The last part of this study consisted of comparison of various groups of institutions and determination of the relation of certain factors to the degree of success of an institution in the training of chemists.

Sources of Data.--Reference books, periodicals, interviews, expert judgments, and questionnaires.

Statistical Treatment.--Coefficient of correlation.

Major Findings.--(1) Technical institutions as a group surpassed the universities, colleges, teachers colleges by a considerable margin. The universities ranked after the technical schools. The colleges ranked third and the teachers colleges were in the last place. (2) Institutions which granted the Ph.D. in chemistry had a considerably higher Ph.D.-Bachelor ratio than other institutions. (3) Of the four major geographic divisions, the institutions in the Middle West were the most productive. The institutions in the West ranked second with eastern institutions and southern institutions in third and fourth places respectively. (4) Privately and publicly controlled institutions did equally well. If the privately controlled institutions were classified as catholic, protestant, or nonsectarian, the latter was the most successful. (5) As a group the American Chemical Society approved institutions were more successful than nonapproved institutions. Nearly all universities were accredited. There were, however, a number of colleges with a high Ph.D.-Bachelor ratio which were not accredited. The combined Ph.D.-Bachelor ratios for approved universities and approved technical schools exceeded the combined ratio of the colleges. For equal number of graduates per institution which earned the Ph.D. in chemistry, a greater proportion of the universities and technical schools were accredited than colleges. For the same Ph.D.-Bachelor ratio a greater proportion of the universities and technical schools were accredited than colleges. (6) The influence of per student college outlay ranged from negligible to moderate, having the greatest influence on the eastern institutions and midwestern universities. (7) In general, institutions which produced the most financially successful graduates were above average in the training of chemists, but the correlation between the two was not large. (8) There seemed to be little correlation between entrance requirements and success in training chemists. The only trend that was detected was that the most successful schools required more mathematics. (9) There was a definite inverse correlation between the number of chemistry graduates per professor and the Ph.D.-Bachelor ratio for the eastern, midwestern, and southern institutions. (10) A definite positive correlation was found to exist between the number of articles per professor in the Journal of the American Chemical Society and the Ph.D.-Bachelor ratio for institutions which granted the Ph.D. in chemistry. The correlation for universities which did not grant the chemistry Ph.D. was small. The amount of work published by the colleges was so small that a correlation study could not be made. (11) In general, those colleges with a high Ph.D.-Bachelor ratio which were not accredited by the American Chemical Society were smaller and had less financial resources than the approved colleges. The chemistry departments in most of these successful non-approved institutions consisted of one or two men.

****

SIPE. H. CRAIG. Assumptions Underlying Committee Reports on High School Science: 1932-1951. Ph.D., 1952, George Peabody College for Teachers. 629 p. Library, George Peabody College for Teachers, Nashville 5, Tennessee.

Problem or Problems.--The problem of this study was to identify and to examine the bases for certain assumptions underlying selected committee reports on high school science published during the period extending from 1932 through 1951. Concerned primarily with the whole field of natural science teaching, these reports were the work of deliberative committees or commissions authorized by organizations having national scope.

Steps or Methods.--The method used in the study was one of critical analysis. An attempt was made to discuss the philosophical basis for the assumptions found in the reports. Each of the twelve reports included in the study has been analyzed for underlying assumptions (a) relating to the pupil, (b) relating to the purposes of education, and (c) relating to the educative process. The bases for the assumptions have been explored with regard to (a) the nature of the pupil, (b) the nature, kind, origin, and use of specific educational values, and (c) the ways of attaining knowledge. Over four hundred assumptions were identified in the study.

Sources of Data.--Reference books and periodicals.

Statistical Treatment.--None.

Major Findings.--Curriculum workers may find the assumptions identified in this study helpful in providing a basis in thought for structuring a course of study in science. The deliberative committees under study have seldom made clear the basis in thought underlying their assumptions. It may be argued that the committees which have not looked into their basic assumptions have produced reports characterized by quantity, rather than by quality, of presentation. This quantity has revealed itself in flowing phraseology, numerous citations, repetitive comment, and loose definition.

****

SMITH, JAMES R. A Study of the Methods of Teaching Laboratory Biology in the High Schools of Delaware County. M.A., 1952, Ball State Teachers College. Library, Ball State Teachers College, Muncie, Indiana.

Problem or Problems.--The purpose of this study was to become familiar with and to determine the frequency of use of the methods of conducting biology laboratory work in Delaware County, Indiana. The study has attempted to survey the methods used by the teachers and the classroom facilities under which they were applied.

Steps or Methods.--After extensive study of the literature on the methods of teaching biology in high school, a questionnaire was prepared by the writer to aid in the collection of data. In gathering data for the study, the writer used the questionnaire in conjunction with a personal interview. The method of presenting the data in this study was through the description technique and the use of tables.

Sources of Data.--Interviews and questionnaires.

Statistical Treatment.--Comparison of frequencies.

Major Findings.--It was found in general that the teacher had very inadequate conditions under which to conduct laboratory procedures. The laboratory work at the ninth grade level was found to be integrated into the daily program as needed. The biology teachers in Delaware County schools use the teacher demonstration method most frequently.

****

STEEN, EVERETT D. A Study of Conservation Education in a Medium-sized High School. M. A., 1952, Ball State Teachers College. Library, Ball State Teachers College, Muncie, Indiana.

Problem or Problems.--The general problem is to present material relative to a conservation program in a medium-sized high school. A further purpose of this study is to offer suggestions as to how a conservation education program might be improved. Another purpose is to suggest a possible resource unit for the teaching of soil conservation in secondary schools.

Steps or Methods.--In order to discover the content and the methods used in the conservation education program, the author conducted interviews. Another aid in analyzing the program was the letters received from experts in conservation education. The last step of the study was the preparation of a teaching unit on soil conservation.

Sources of Data.--Reference books, periodicals, experimental groups, interviews, and expert judgments.

Statistical Treatment.--None.

Major Findings.--If schools are to have effective programs of conservation education, teachers should know the real meaning of conservation education and be aware of the objectives in teaching conservation. Conservation education is probably more effective if community problems and resources are used as a basis of the program. Field trips seem to make conservation vital to students.

****

SUBARSKY, ZACHARIAH. An Experiment in Reducing the Informational Dimension of Prejudice. Ph.D., 1952, Columbia University. 119 p. Library, Teachers College, Columbia University, New York, New York.

Problem or Problems.--The "shrinking of the earth" through technological advances has brought into special focus the problem of relations between people of different race and culture. Lack of information or misinformation serve to maintain prejudice in interhuman relations. The study of social science and biological science each may contribute to help diminish prejudice. Can the effectiveness of these two subjects be enhanced through integration? If so, how may the subjects be integrated within the framework of their other objectives? How much more effective than separate conventional courses can an integration be in reducing the informational dimension of prejudice?

Steps or Methods.--A term of tenth-year social studies and tenth-year biology were integrated. Evaluation instruments were adapted or constructed. Experimental classes were set up to take the integrated courses. Comparable control classes were set up to take the conventional courses in biology and social studies. Experimental and control classes were compared.

Sources of Data.--Experimental groups and control groups.

Statistical Treatment.--Mean, standard deviation, coefficient of correlation, and Chi square.

Major Findings.--The differences between the experimental and control groups were not consistent in all phases of the study. But in the overall picture in the analysis of the data, the shift in the direction of freedom from prejudice, as measured by the tests employed, was significantly greater in the experimental groups than in the control groups. The subjects of this experiment were pupils in specialized high schools; whether the findings would apply to more representative students remains to be determined.

****

SULLIVAN, JAMES BERNARD. Science in New England Teacher Training. Ph.D., 1952, Boston University. 461 p. Library, School of Education, Boston University, Boston, Massachusetts.

Problem or Problems.--The problem is stated as being concerned with the history of the training in science of public school teachers in New England from 1635 to 1950.

Steps or Methods.--The historical method and in part the survey method were employed. Catalogues of colleges of arts and sciences, of normal schools and teachers colleges, of city training schools, and of academies, teacher seminaries, and teacher institutes were examined for every tenth year. The record of the data gathered in this way provided a means for its study and comparison to bring forth trends in the teaching of science in teacher training.

Sources of Data.--Reference books, periodicals, and textbooks.

Statistical Treatment.--None.

Major Findings.--(1) The only teachers who received any formal training in science in the Colonial Period were those who were educated in college. (2) Science had no place in the curricula of the public schools during the Colonial Period. (3)

Many teachers in the common schools during the Colonial Period had no education above the common school. (4) Academies and high schools were important sources of teachers up to 1900 and included in their English courses a liberal treatment of the sciences. (5) Girls received secondary school training for the first time in the female seminaries and co-educational academies of the early nineteenth century. (6) From their inception the normal schools usually devoted a generous portion of their curriculum to the study of science; but since many of the teachers in the grades took only a one-year course up to 1885, their science teaching depended largely on their high school science background. (7) By 1890, most of the normal schools gave a two-year prescribed course in which fifteen to twenty hours of science work were required. These courses in science were in a variety of subject-matter fields and were usually of short duration. This condition existed until about 1920. (8) The amount of required science in the normal schools declined until an average of six semester hours of science was required in 1930. By 1950, an average of twelve semester hours of science was required. This was divided equally between the physical sciences and the biological sciences. (9) The amount of science taught in the public grade schools seemed to follow the same trend as the teaching of science in the normal schools and teachers colleges. (10) Elementary science began to replace nature study in the elementary grades about 1930 and by 1950 had assumed a place in the curriculum of the elementary school which was comparable to that occupied by nature study before 1920. (11) The colleges which served as the principal source of secondary school teachers usually made available a generous array of science courses. (12) Provision for the professional training of secondary-school science teachers began to be made about 1890. Most of the colleges offered enough professional training to satisfy the requirements for certification. (13) The science curriculum of the secondary school changed from one in which a variety of courses were offered in the nineteenth century to a standard program of general science, biology, physics, and chemistry after 1920. (14) Some in-service training was provided in science in the programs of the teachers institutes and the early summer schools for teachers.

****

TAYLOR, NORMAN L. Use of a River as a Habitat for the Study of Biology. M.A., 1952, Ball State Teachers College. Library, Ball State Teachers College, Muncie, Indiana.

Problem or Problems.--This paper is a study of the biology of an area of a river with the idea of developing a teaching unit that may be used in the junior or senior high school.

Steps or Methods.--A site on White River was chosen as a typical area of a river. Consideration was given to the accessibility of the area and the condition of the river itself.

Sources of Data.--Reference books, periodicals, and habitat studies.

Statistical Treatment.--None.

Major Findings.--By using the ideas gained from this study a teaching unit was devised to meet the speculated needs and interests of students using a river as a habitat for the study of biology.

****

TURNER, BYRON J. Fuels: A Guide and Source Book for the Study of Fuels and Some Problems Arising from the Utilization of Fuels. Ed.D., 1952, Columbia University. 265 p. Library, Teachers College, Columbia University, New York, New York.

Problem or Problems.--(1) To determine some of the present and possible future relationships of fuels to the wealth and welfare of people and to survey some of the many scientific and technologic and sociologic questions, ideas, and problems concerning fuels as they relate to the people who live and work through the production and consumption of fuels. (2) To provide materials which can be used in training the teachers for our schools and also to provide a source book for use by teachers in service and by all who wish to gain a fuller understanding of fuels.

Steps or Methods.--A survey was made of a representative sample of current textbooks and courses of study being used in public schools. Data obtained by others working in this area were checked, especially with respect to teacher training. An extensive study of current information regarding fuels and fuel problems was made, drawing upon current books, periodicals, industrial publications, government publications including the United Nations, and research reports. Using the data from these sources, a brief summary of information and problems concerning fuels was prepared.

Sources of Data.--Reference books, periodicals, and courses of study.

Statistical Treatment.--None.

Major Findings.--The textbooks and current courses of study give inadequate attention to the study of fuels and fuel problems. Teacher education does not provide sufficient training for effective teaching in the area of fuels and related problems arising from the production and utilization of fuels.

****

WALDEN, DELBERT L. Sample Resource Units in the Integration of Health and Science for the Seventh and Eighth Grades. M. A., 1952, San Diego State College. Library, San Diego State College, San Diego, California.

Problem or Problems.--It was the purpose of this study to correlate the areas of health and science through the use of resource units. The resource units contain intercorrelated material on "The Air We Breathe" and "Continuity of Life." The material included in the units was selected because it was considered to be interesting and comprehensible to students of junior high school age.

Steps or Methods.--(1) Review of literature. (2) Examination of surveys of pupil health interest. (3) Examination of curricular material on the units. (4) Division of units into sub-topics. (5) Development of resource units. (6) Inclusion of textual, teaching, and A-V materials.

Sources of Data.--Reference books, periodicals, textbooks, and courses of study.

Statistical Treatment.--None.

Major Findings.--It was possible to integrate the areas of general science and health education and give proper emphasis to both subject areas.

****

WARREN, PERCY HOLMES. The Education of High School Science Teachers at Madison College. Ed.D., 1952, Columbia University. 144 p. Library, Teachers College, Columbia University, New York, New York.

Problem or Problems.--(1) To discover significant conditions and major problems related to the education of science teachers at Madison College, and (2) to draw implications from these conditions and problems for the purpose of recommending changes in basic organizations and fundamental policies for the education of secondary school science teachers at Madison College.

Steps or Methods.--(1) Study of Preliminary Annual Reports of Virginia High Schools to the State Department of Education. (2) Study of Madison College graduates teaching science (questionnaire). (3) Study of literature in areas of general education, secondary education, teacher education, and science education.

Sources of Data.--Questionnaires and study of annual high school reports to Virginia State Department of Education.

Statistical Treatment.--Comparison of frequencies.

Major Findings.--A program (basic organization and fundamental policies) for the education of science teachers at Madison College is proposed. Although this study deals with a specific problem in teacher education within a particular institution, it is believed that the recommendations are sufficiently support to be of general interest.

****

WASHTON, NATHAN SEYMOUR. Applying Biological Principles to Physical Sciences. Non-thesis, 1952, Queens College. Author, Queens College, Flushing 67, New York.

Problem or Problems.--To determine the applications of several biological principles to a generalization, concept, principle, or problem in the physical sciences, astronomy, chemistry, geology, or physics. To obtain a list of these generalizations or principles in the physical sciences which may be more familiar to students of biology and/or giving the students useful concepts or items of knowledge from the physical sciences so that they will understand the biological principles.

Steps or Methods.--A sample of five principles of biology for general education was listed in a questionnaire. Fifty questionnaires were returned by members of The National Association for Research in Science Teaching representing all the areas in the natural sciences. The applications of the biological sciences to the physical sciences were listed and tabulated.

Sources of Data.--Reference books, periodicals, courses of study, expert judgments, questionnaires, and previous studies.

Statistical Treatment.--None.

Major Findings.--Several biological principles may be applied to the following concepts in physical science and these concepts were listed most frequently: (1) potential, kinetic and transformation of energy; (2) factors governing the speed of chemical reactions; (3) conservation of matter and energy; (4) atomic-molecular theory; (5) chemical change and synthesis of compounds, oxidation-reduction; (6) the changing earth's surface and the interaction of non-living environmental factors and living organisms; (7) kinetic-molecular hypothesis; (8) mechanics of liquids including nature of solution and diffusion.

****

WEAVER, HOWARD EUGENE. State Park Naturalist Programs: Their History, Present Status, and Recommendations for the Future. Ph.D., 1952, Cornell University. 633 p. Mann Library, Cornell University, Ithaca, New York.

Problem or Problems.--To discover the extent to which state park naturalists had been employed in the United States, to observe the use of state park museums and nature trails by naturalists, to determine the present status of the state park naturalist program, and to make recommendations for improving the program.

Steps or Methods.--(1) Personal letters to each state park director in the United States to determine extent of the park naturalist program. (2) Check of latest park literature. (3) Questionnaire for park naturalists and chief naturalists. (4) Personal visits to state parks employing naturalists, interviews, participation in activities, inspection of facilities. The author traveled a total of 14,000 miles to visit 34 state parks in Florida, California, Illinois, Indiana, Minnesota, Mississippi, New York, North Carolina, and Tennessee.

Sources of Data.--Questionnaires, interviews, personal visits, reference books, and periodicals.

Statistical Treatment.--None.

Major Findings.--State park naturalist programs are serving as effective means of promoting better use of state park facilities and developing appreciations for park values. Likewise, naturalist programs are helping to teach conservation principles in the out-of-doors. World War II brought a drastic reduction in the employment of state park naturalists. The strongest active naturalist programs employ a full-time chief naturalist or senior naturalist, or reimburse the chief naturalist for services rendered during the winter. Pre-service training programs for naturalists are highly desirable. The most prominent activities conducted by state park naturalists are nature hikes and talks on some phase of natural history. Emphasis should be placed on nature and conservation education rather than on entertainment such as square dances, camp fires, and games. Nature museums and self-guiding nature trails should be eliminated where they cannot be properly maintained.

****

WELCH, RICHARD FLOYD. Some Demonstrations for High School Science. M.A., 1952, Western Michigan College of Education. 72 p. Library, Western Michigan College of Education, Kalamazoo, Michigan.

Problem or Problems.--The problem of this study is to develop demonstrations that will easily demonstrate the seldom demonstrated, and to develop new demonstrations illustrating old principles, with equipment readily obtained in the small high school.

Steps or Methods.--Not reported.

Sources of Data.--Reference books, periodicals, textbooks, and laboratory experimentation.

Statistical Treatment.--None.

Major Findings.--(1) Demonstrations illustrating the seldom demonstrated can be developed. (2) A survey of science textbooks and other science publications will supply many needed demonstrations. (3) Many demonstrations that are needed may be developed in the high-school laboratory. (4) Many inexpensive demonstrations can be developed. (5) Many demonstrations that can be performed rapidly can be developed. (6) Previous experience in a specialty field (i.e. Laboratory Technician) can be helpful in developing new demonstrations. (7) Lack of equipment may be overcome by novel use of available equipment.

****

WELLS, FORREST E. Desirable Physical Facilities for Teaching Science in the Junior High Schools of Indiana. M.A., 1952, Ball State Teachers College. Library, Ball State Teachers College, Muncie, Indiana.

Problem or Problems.--The purpose of this study was to determine the desirable facilities required for teaching science in the junior high schools of Indiana.

Steps or Methods.--The direct visitation and consultation method of research was employed for this study. Prior to the selection of the schools to be used in this study, a series of charts were drawn up representing each area of investigation. The charts used to record data on during the period of visitation were identical to the tables found throughout the paper.

Sources of Data.--Interviews and questionnaires.

Statistical Treatment.--None.

Major Findings.--The conventional type of school desks is no longer satisfactory for the science room. Some type of table with movable chairs seems to be most suitable. Some type of fire extinguisher is desirable in each science room. The opaque shades should be incorporated in each science room. Also, it is to the advantage of the science teacher to have a screen located permanently in the science room.

****

WELLS, JOHN CLARENCE. Manual of Photography for Teachers. Ed.D., 1952, Columbia University. 100 p. Library, Teachers College, Columbia University, New York, New York.

Problem or Problems.--(1) To show some of the practical and effective uses of photographic techniques in education, (2) to help teachers select and understand the use of basic photographic equipment, and (3) to serve as a guide for teachers who wish to experiment with photographic techniques in their own schools.

Steps or Methods.--(1) Examples of how teachers have used photography illustrate photography being used at all grade levels, in various subject matter areas, and both in and out of the classroom. (2) An analysis of the examples.

Sources of Data.--Personal experience, reference books, and periodicals.

Statistical Treatment.--None.

Major Findings.--The use of the photographic processes, based on scientific, optical, and chemical principles, requires certain equipment. Teachers must make use of photographic equipment; therefore, the most common pieces are discussed and evaluated. Certain cameras and enlargers are treated in detail because they are the two major pieces of equipment used and sometimes represent a considerable expenditure of money. In order to be of specific, practical help to teachers, several photographic techniques are discussed in detail. These include correct handling of the camera, film development, contact printing, projection printing (enlarging), use of artificial light indoors, preparation of lantern slides, and preparation of prints for the press. Composition is treated in a general way. Equipment discussed is kept to a minimum, and techniques are simplified as much as possible.

****

WHITFORD, ROBERT H. Guide to Physics Literature. Ed.D., 1952, Columbia University. 220 p. Library, Teachers College, Columbia University, New York, New York.

Problem or Problems.--The study involved compilation of a guide to library materials in physics at the college level. Selectivity and organization were the watchwords, in order that orientation and guidance might most conveniently be furnished to users, among whom would be students, librarians, teachers, and scientists working outside their own familiar specialties. Library tools and techniques have been included, and background areas sufficiently sketched without leading too far into bordering fields such as engineering.

Steps or Methods.--Parallel methods of compilation were used. Thus four outstanding library collections were surveyed via card catalogs and stacks, these searches being supplemented by gleanings from bibliographical sources and from long personal experience as a science technology librarian. References meeting inclusion criteria were arranged in a diversified approach pattern representing usual lines of inquiry, such as biographical, experimental, terminological, educational, topical, etc. Explanatory text and book citations have been organized into a connected account interspersed with interesting background comments. Besides indicating informational sources and outlining special techniques, the guide sketches physics literature in general, so as to call attention to the different kinds of printed materials available but often overlooked.

Sources of Data.--Reference books, periodicals, and textbooks.

Statistical Treatment.--None.

Major Findings.--The guide, a product of library research, is itself a research tool. Its compilation has involved selection, description, comparison, and evaluation of the literature of physics so as to organize it for maximum functional utility. As this literature becomes more voluminous, the importance of knowing how to utilize its hidden resources grows apace. Library guides in special subject fields have been likened to crossroad signposts.

****

WILLIAMS, CLAIBORNE JAMES. An Analysis of the Physical Science Subject Matter a Competent Teacher of General or Physical Science Needs to Know. B.S., 1952, Tennessee A. and I. State University. 24 p. Department of Science Education, Tennessee A. and I. State University, Nashville, Tennessee.

Problem or Problems.--The problem of the study is to locate important physical science principles that a teacher of general or physical science needs to know and to evaluate a typical college science curriculum in order to see how adequately it meets this need.

Steps or Methods.--(1) Location of important physical science principles in textbooks. (2) Comparison of these principles with Wise's list of physical science principles important for general education. (3) Selection of a jury of teachers from science staff at A. & I. State University. (4) Evaluation by jury of science curriculum at Tennessee A. & I. State University in the light of how well it provided for development of understanding of the listed principles.

Sources of Data.--Reference books, periodicals, textbooks, and expert judgments.

Statistical Treatment.--None.

Major Findings.--(1) Ninety-one physical science principles were located as being of great importance in general or physical science courses. (2) All of these principles are covered in some course offered in the Tennessee A. & I. University, but 18.5 percent were listed as "barely covered" and 6.5 percent as "inadequately covered." (3) Science courses required of prospective general science teachers should be revised to include experiences which will help develop adequate understanding of all principles they may be required to teach. (4) This revision should require all such teachers to take a one-year course in physical science, or courses in geology, meteorology, and astronomy in order to learn the necessary principles which fall in these areas.

****

WOODBURN, JOHN H. An Investigation of the Relationship Between the Science Information Possessed by Ninth Grade General Science Students and Certain School and Out-of-School Science Experiences. Ph.D., 1952, Michigan State College. 191 p. Author, Illinois State Normal University, Normal, Illinois.

Problem or Problems.--To determine degrees of relationship between the science information possessed by ninth-grade students and certain school and out-of-school factors as intelligence, sex, membership in Scouts and 4H Clubs, interest in reading science books, social and economic home conditions, and prior instruction in science through the sixth, seventh, and eighth grades.

Steps or Methods.--Obtaining initial and final scores of 1,973 ninth-grade general science students, on the Read General Science Test. Similar data were obtained from 198 ninth-grade students, who were not enrolled in general science through the year, and also from 226 tenth-grade biology students, who had not taken general science through the ninth grade. The classification of the students in categories representative of the school and out-of-school factors included in the study was based on the students' replies to questions on a personal information form, on their intelligence quotients obtained from school office files, and on information obtained from conferences and correspondence with their teachers. The identity of relationship between a factor suspected of affecting the possession of science information was revealed by the comparison of the test scores of groups differing in degree of possession of the suspected factor.

Sources of Data.—Tests, personal information forms, school files, conferences, and correspondence with teachers.

Statistical Treatment.—None reported.

Major Findings.--The results obtained from the initial administration of the Read Test show that all three groups of students were familiar with nearly 50 percent of the information covered by the Read Test. Significant gains were shown by each of the three groups with the ninth-grade group, who were taught general science, making the greatest gain and the ninth-grade group, who were taught no general science, making the least. Whatever it is that gives a student an advantage in marking intelligence tests also gives that student an advantage in responding to the items on the Read Test. This is true both prior to and after instruction in general science. Intellectually bright and dull students have equal opportunities, however, to gain additional science information through classroom experiences. Boys invariably show higher mean scores on the Read Test than do girls even though the girls in this study enjoyed a significant advantage in intelligence. Scout or 4H Club experience, "good" home background, interest in reading science books and prior instruction in science, all show positive relationship with the possession of science information. With the exception of interest in reading science books, however, the superiority associated with each of these factors is overlapped by superiority in intellectual ability. None of the factors considered in this study appears to be significantly related to the students' gaining of additional science information while enrolled in general science classes.

****

YALE, FRANCIS GAYMON. A General Education Course in Science for Non-Science Majors at the University of Denver. Ed.D., 1952, Columbia University. Russell Library, Teachers College, Columbia University, New York, New York.

Problem or Problems.--To devise a plan by which students in the liberal arts college at the University of Denver, who are not primarily interested in science, may participate in some science experiences which will be meaningful, useful, enjoyable, and stimulating to them.

Steps or Methods.--Survey of literature for the previous ten years (approximately), relative to general education courses in science at the college level with particular attention given to the use of the problem approach method of studying science. Establish course objectives. Describe implementation techniques of the problem approach to a general education science course for a specific situation.

Sources of Data.--Reference books, periodicals, and previous teaching experience with general education science courses.

Statistical Treatment.--None.

Major Findings.--A student-centered problem approach method appeared to afford a reasonably satisfactory solution of the main problem.

****

ZIEN, DEWITT. A Study of the Significance of Microclimates of Pavements. Ph.D., 1952, Cornell University. 295 p. Mann Library, Cornell University, Ithaca, New York.

Problem or Problems.--This study deals with the educational significance of microclimates of the playground pavement of the Boynton Junior High School, Ithaca, New York, the road next to the author's house in Newfield, New York, and eight miles of highway between the two.

Steps or Methods.--The author made extensive studies of the microclimates of paved areas, developing and using the instruments, techniques, and devices necessary to the completion of these studies. Factors investigated included air and wind, temperature, water, sunshine, light and darkness, earth, altitude, slope, motion. The educational values of these materials were tested by incorporation into the instruction in junior high school general science, both in the classroom and during field trips and excursions.

Sources of Data.--Field studies, reference books, periodicals, and courses of study.

Statistical Treatment.--None.

Major Findings.--The two paragraphs that follow present examples of activities involved and summarized in this study.

The pupils were told that they were going outdoors to see " a few little things" around the school. Here students were led to observe, to hear, to touch, to measure, and to be guided to conclusions they were able to draw. The temperatures they observe and the sun's angle that they measure make them "see" the sun as they never have seen it before. Temperatures change with the rain. Rain affects the water in the earth and the humidity in the air. The motion of the air brings changes in weather. Motion associated with various forms of energy and matter can be sensed. All these factors interweave in the pupil's mind, not as separate classroom experiments, but as something he can observe in his everyday environment.

In the specific aims of the New York State Syllabus one finds stress on such points as: appreciation and awareness of the factors of environment, study of the common phenomena of immediate environment, use of the scientific method in solving problems, organization of experiences, and an understanding of the environment's relation to and use in the world's work as a basis for the appreciation of the vital place of science in the community. The author believes he was able to meet such aims more fully by using the methods employed in this thesis.

He found through experience in using outdoor laboratories that his pupils had a better approach to scientific attitudes and learned more and enjoyed their course more than had any previous classes.

****

*JONES, LAYTON F. Equipment Needs for a Biology Course in the Small Montana High School. M.Ed.,1952, Montana State University. 96 p. Author, Willits Union High School, Willits, California.

Problem or Problems.--To develop a list of biological science equipment suitable to the needs and the limited finances of the small Montana high school.

Steps or Methods.--A questionnaire was sent to biology teachers in small high schools of Montana, college faculty members were interviewed, lists were studied, and professional literature was examined.

Sources of Data.--Reference books, periodicals, interviews, questionnaires, and equipment lists published by various State departments of education.

Statistical Treatment.--Comparison of frequencies.

Major Findings.--Most of the authorities agreed on which items of equipment should be included in a minimal list, but certain items were not agreed upon, nor was there general agreement on the number of each item necessary to a biology course. Equipment lists showing items, number recommended, unit cost, and cumulative costs were prepared for individual apparatus and general classroom apparatus. Class size of fourteen students was the basis for lists. Costs at the time of the study meant that the total per pupil investment required was $54.09.

****

*This study arrived too late to be included in its proper place.